MODERN PLASTICS

APRIL 1952

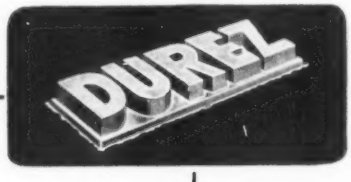
First choice for the most jobs!

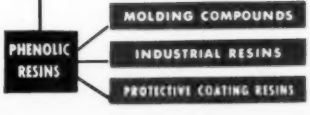
Uniform quality and consistently superior performance have made Durez 791 black general-purpose phenolic a standard in the industry for years. More molding plants use more 791 than any other single general-purpose material.

When you recommend and use this compound, you get the benefit of the widest range of adaptability ever made available in one material for your G. P. jobs, whether plunger, transfer, or compression molded. Having a long flow period, fast cure, and excellent glossy surface, 791 has won its leadership through constant care maintained to assure uniformity in production that meets the Durez standard.

Whenever you want a rich brown tone you get all the advantages of 791 in Durez 740. The two compounds are identical except for color.

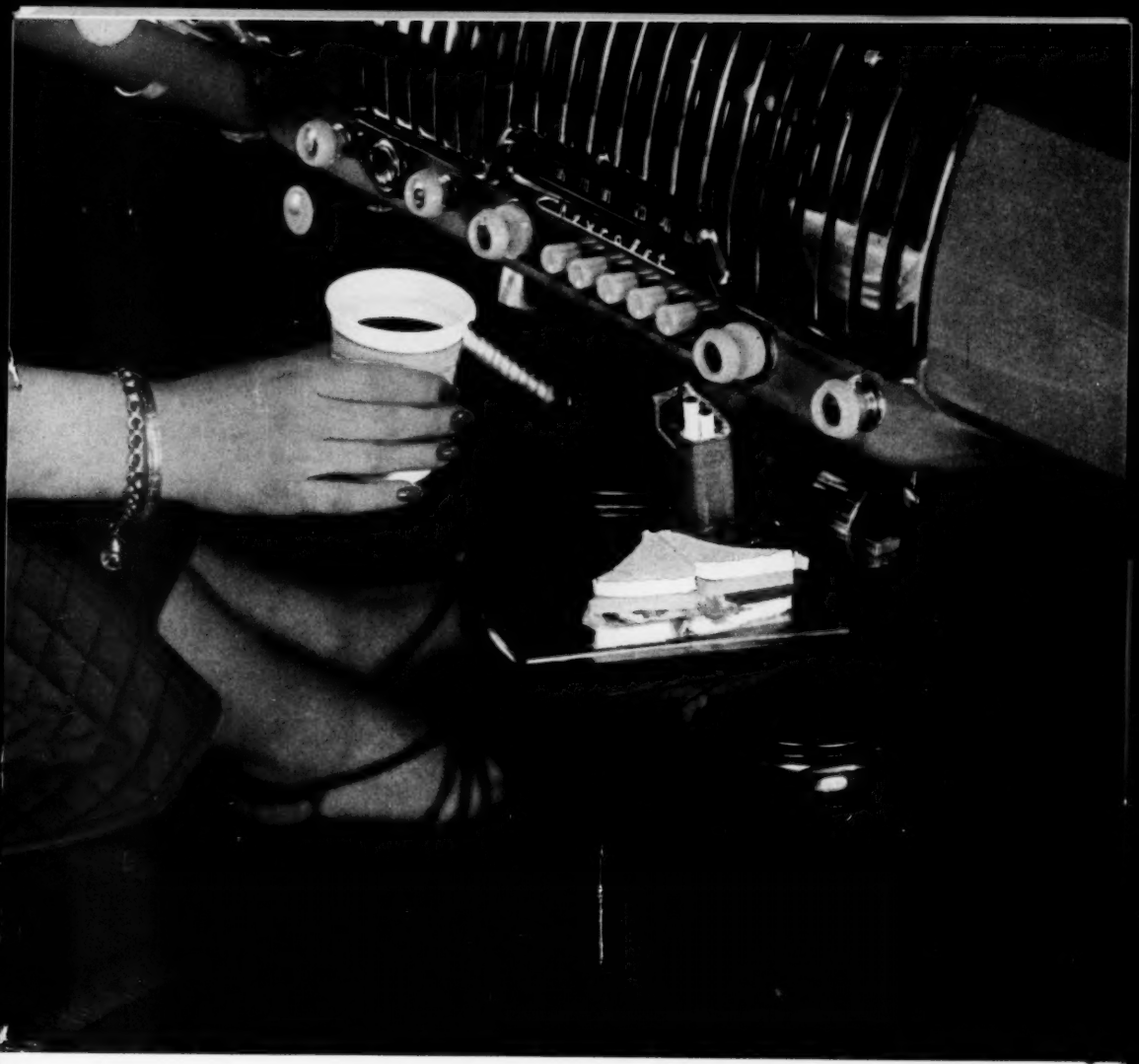
Try these compounds on your next general-purpose production runs and enjoy the satisfaction of complete confidence in your moldings. Sample and data will gladly be sent—write to Durez Plastics & Chemicals, Inc., 1204 Walck Road, N. Tonawanda, N. Y.





Use the most generally used general-purpose phenolics

PHENOLIC PLASTICS *that fit the job*



Catalin Styrene and TRAV-L-TRAY

Promise a Refreshing Pause!

Here's something you *can* take with you—and repeatedly enjoy along the way! In Trav-L-Tray, the folks at Paul-Reed* come within hand's reach of the motorist and front seat companion with a shell-shaped tray facility that *rides* clamped and concealed under the cowl . . . set and ready at a finger's touch to swing swiftly into the open and comfortably serve a roadside snack or spread!

Trav-L-Tray, like all products molded of low-cost CATALIN STYRENE . . . is light-weight, sturdy, colorful and easy to clean. Shallow, molded-in surface treads prevent cups from spilling or plates from slipping.

By virtue of various attachments, Trav-L-Tray's appreciated utility is equally well extended to other locations in the car, also at home . . . And, for each use, reflects creditably upon the versatility of the molder's and manufacturer's specified plastic raw material, CATALIN STYRENE!

**A product of Paul-Reed, Inc., Charlevoix, Mich. Custom molded by United Plastics, Inc., Vassar, Mich.*

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin's chemical family includes a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

VOLUME 29 APRIL 1952 NUMBER 8

CONTENTS

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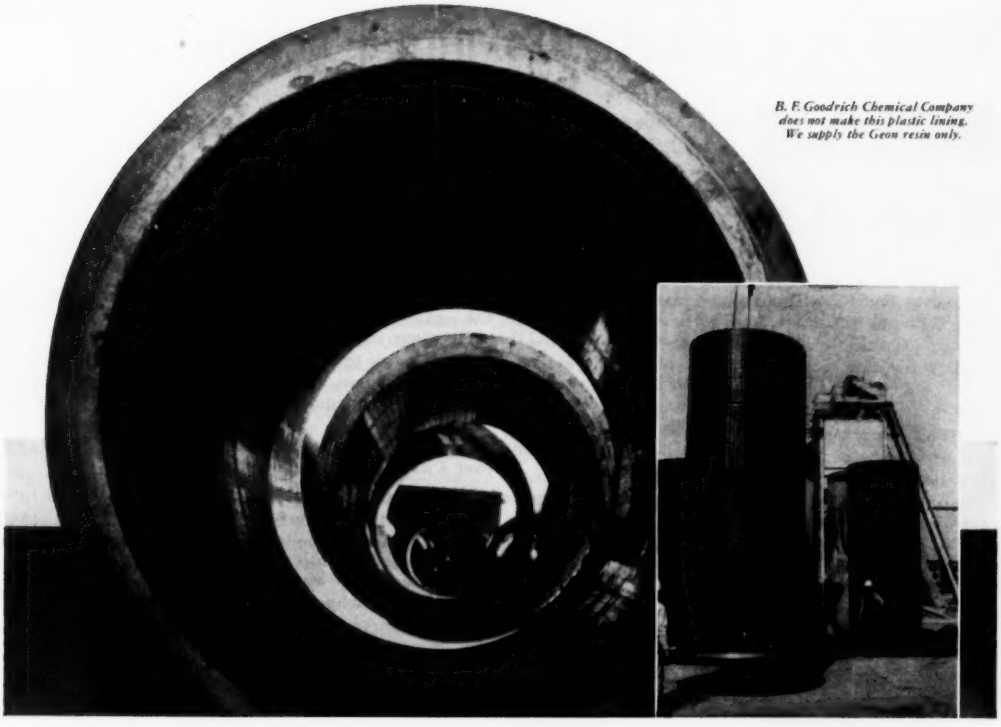
*Reg. U.S. Pat. Office

Another new development using

B. F. Goodrich Chemical *raw materials*



B. F. Goodrich Chemical Company does not make this plastic lining. We supply the Geon resin only.

WHAT NEXT! PLASTIC-LINED SEWER PIPE THAT FIGHTS CORROSION

THIS sewer pipe pictured here is lined with a special plastic sheeting—"T-Lock Amer-Plate"*—developed by an alert manufacturer using Geon resin. The lining protects the concrete against corrosive industrial and septic sewage—gives the pipe years of extra life.

You can see the big savings that makes. Concrete pipes like these last longer and withstand attack by corrosive wastes—thus providing maximum economy for the industrial user or municipality.

Besides pipe, this vinyl plastic sheeting may also be used for lining manholes, underground gauging chambers, distribution chambers, etc., and for concrete tanks.

The manufacturer chose Geon polyvinyl resin as the basic material because it provides extreme toughness and high resistance to corrosive chemicals. What's more, Geon is not affected by oil and grease, has low water absorption, and resists oxidation.

Geon materials—resins, latices and plastic compounds—help improve and develop many products for industry and the home—from flooring to rigid, translucent panels. For technical bulletins and advice, please write Dept. GA-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

*Patented

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

question:

When is a substitute not a substitute?

answer:

When it's BETTER than the original

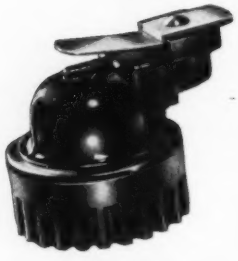
Take molded plastics, for instance. For years, they have been used to replace other established materials. And, when soundly engineered, the replacement . . . molded plastics . . . proved so much better than the original material that it has been used ever since.

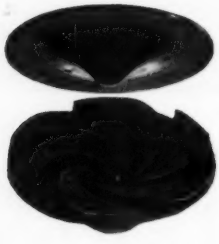
Naturally, plastics do not provide the answer to every materials problem. Far from it. Plastics have their limitations as well as their advantages. But new materials, and improvements on old ones . . . plus steady advancement in molding techniques . . . are constantly broadening the field in which plastics can do a better job.

As a result, Chicago Molded plastics are now replacing aluminum, brass, copper, etc., at a higher rate than ever before . . . over a million pounds a month!

Maybe there's an idea here for you

Maybe some of the component parts of your product can be made as well or better of molded plastics. Maybe you can, at the same time, save sufficient metal on one or two parts to greatly improve your material position. At least, it's worth looking into.





So . . . why not talk it over with an experienced plastics molder . . . someone like Chicago Molded, for instance. We've been in the business for over 32 years. During that time we've handled practically every type of plastics application and molded all of the various materials. Naturally, we've learned a lot. We can tell you quickly whether yours is a practical plastics application. We can help you develop it or tell you when to forget it. We have the know-how and the facilities to get into production without delay and to meet promptly your largest quantity requirements.

Let's talk it over

Let's find out, first, whether you should use plastics and then go on from there. A Chicago Molded engineer will be glad to meet with you at any time . . . without any obligation on your part. Just write or phone.

CHICAGO MOLDED

PRODUCTS CORPORATION

CUSTOM MOLDERS OF ALL *Plastics*

1046 NORTH KOLMAR AVENUE • CHICAGO 51, ILLINOIS

EDITORIAL

The Men Behind Reinforced Plastics

The Seventh Annual Technical Session of the Reinforced Plastics Div. of S.P.I. will be held April 9 through 11 at the Edgewater Beach Hotel, Chicago.

The convention and the concurrent exhibit of recent reinforced plastics applications will be exciting and inspiring—particularly to industrial end users of plastics who have been toying with the idea of using these materials.

Expansion of output in both resins and fibrous reinforcements assures sufficient quantities to increase the molding and fabrication end of the business fully 50% this year. At molder and laminator level, the equipment situation is improving rapidly, with new preformers, new big-capacity presses, and new handling equipment being installed.

The broadening of areas of usefulness of reinforced plastics proceeds apace with the addition of reinforced alkyd molding compounds, low pressure silicones, improved diallyl phthalate, styrene-based polyesters with extremely high heat resistance, new grades of epoxys, new cloth and mat coating methods for all these resins, and new finishes for reinforcements which improve properties in completed products. All are contributory to the present aggressive tone of this section of the industry.

Which brings us to the main point in this editorial: in free and willing exchange of know-how, in thoroughness of discussion on technical, engineering, and marketing matters, in general enthusiasm and appreciation of each man for each other man, there is no group in this industry or any other industry anywhere on the face of the globe to equal this Reinforced Plastics Div. Its conferences are models to be studied by conferring groups in every other industry.

This is very important to the prospective end user of custom-molded reinforced plastics components. It means that such a prospective customer will get not only the advantage of the specialized knowledge of his molder, but also of the total know-how of the industry.

There are no "wise guys" in reinforced plastics. Nobody knows it all or even more than a small part of it all. But everybody knows that everybody else will give him some help on his problem. This will naturally result in better applications, better customer satisfaction, and better business in reinforced plastics.

Possibly inevitably, the time will come when the structure of competition in this section of the industry will be such that the exchange of know-how will be curtailed and suspicion will take the place of true industrial friendship. We believe that time is far distant, because applications, both military and civilian, looming up for these materials, and new know-how still to be developed, are both terrific in scope.

We can now mold out of reinforced plastics an electronic resistor element weighing, with metal component, one tenth of an ounce. We can also mold in one piece, on production basis, a 36-ft. LCVP. We can mold a complete refrigerator interior, or a telephone booth, or a garage door, or a thousand other things which can be made better in reinforced plastics.

We can do this, not only because of the materials, equipment, and methods, but also because of the cooperative spirit that pervades the entire reinforced plastics industry.

President and Publisher

CHARLES A. BRESKIN

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THIS TINY PLASTICS INSULATOR WITHSTANDS A 3,541-lb. PULL!

In this dramatic demonstration, an automobile weighing 3541 pounds was suspended from a single plastics insulator less than $\frac{3}{8}$" in diameter. This high-strength part, specially developed by Richardson engineers, took the full load (38,000 psi) without distortion or failure.

MADE FROM A SPECIAL INSUROK® MOLDED LAMINATE DEVELOPED IN RICHARDSON LABORATORIES FOR *Reliable* ELECTRIC COMPANY

For their "Straightline" powerline splice, Reliable Electric Company, Chicago, needed an insulator with incredible strength—the ability to withstand tensile loads of 2,000 pounds and more. Many different insulating materials were tried, but none stood up to this critical strength requirement.

Richardson engineers solved the problem by developing for Reliable a special INSUROK molded laminate, and then molding the special shape to close tolerances. This rugged material has more than twice the strength required. Furthermore, it provides high dielectric strength, low moisture absorption, and good arc resistance—other important requirements.

In hundreds of such applications, Richardson's "Specialized Plastics Services" are solving difficult problems for industry. Write for full information.

CONSULT RICHARDSON ON YOUR SPECIAL PLASTICS JOBS

This Reliable Electric Company application is typical of hundreds in which Richardson engineers have solved difficult plastics problems for industry. The Richardson Company's unique 4-point plastics service — Materials Development, Engineering, Molding, and Laminating — are available for your use.

The RICHARDSON COMPANY

FOUNDED 1858 — LOCKLAND, OHIO

2789 Lake Street, Melrose Park, Illinois (Chicago District)

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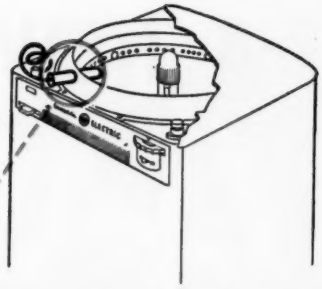


Light-bulb housing of molded Du Pont Nylon

Light-bulb housing molded for General Electric Company, Automatic Washer Division, Trenton, New Jersey, by General Electric Company, Plastics Department, Pittsfield, Mass.

withstands high temperatures and caustic solutions in automatic washer

A "plus feature" of the new General Electric automatic clothes washer is a light which provides interior illumination for cleaning and emptying the machine. The lighting installation consists of a 15-watt 120-volt bulb, a wire spring, aluminum sheath and wires. These are enclosed in a housing which projects through a rubber gasket into the washing basket area.

The design of the housing presented an engineering problem. A material was needed that would withstand the heat generated by the bulb and water-heated air during the washing cycle. Also, the material had to endure the continuing vibration of the agitator, splashing hot water, and various types of both mild and caustic cleaning solutions.

Of all the materials tested, only Du Pont nylon plastic met these requirements. Nylon withstands continuous use up to 250°F. and is unaffected by caustic solutions. It is strong and tough . . . resists vibration and shock even in thin sections (0.040" in this housing). It is translucent . . . does not discolor because of the internal heat. Nylon has been proved in this application by continuous accelerated tests equivalent to 10 years' use.

This is another example of how Du Pont nylon can do a job where other materials fail. Perhaps it can do a job for you. For further information on nylon and other Du Pont plastics, write:

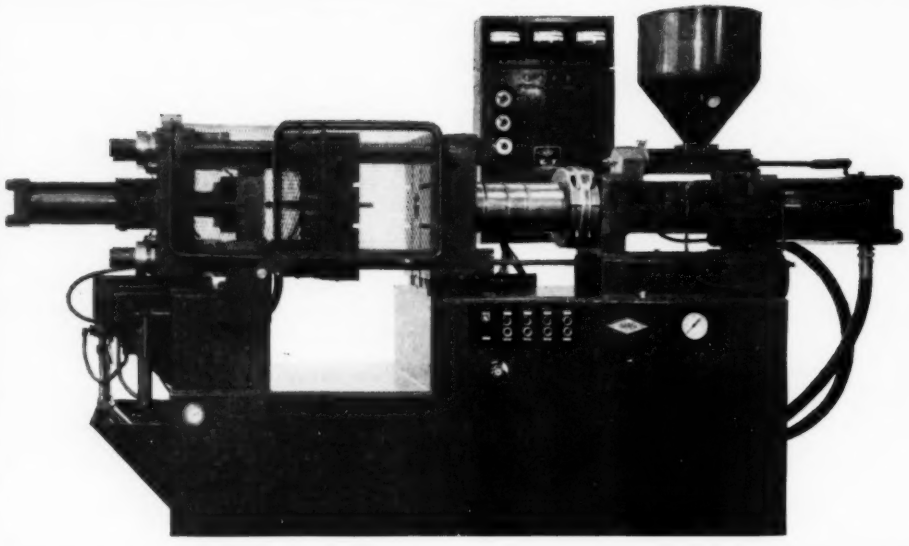
E. I. du Pont de Nemours & Company (Inc.)
Polychemicals Department, District Offices:
350 Fifth Avenue, New York 1, New York
7 S. Dearborn St., Chicago 3, Illinois
845 E. 60th St., Los Angeles 1, California

DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
PLASTICS • CHEMICALS

A NEW 4 ounce

PLASTIC MOLDING MACHINE

Impco HA4-175



Features:

- High Capacity plasticizing cylinder - up to 60 lbs. per hour
- Adjustable prepack, positioning action and adjustable injection stroke for all type granules.
- Rapid advance (differential) hydraulic circuit on injection piston.
- Sliding press assembly for nozzle and sprue accessibility - hydraulically operated.
- Large free area under platens.
- Separately mounted control panel for timers and temperature controllers.
- Automatic lubrication and oil temperature control.
- Completely automatic if desired.

Specifications:

- Injection Capacity 4 ounces (prepacked to 6 ou
- Injection Pressure (Plunger) . . . 21,750 lbs. p. s.
- Clamping pressure (fast action) . . . . 175 tons
- Mold space (between tie rods) . . . 12½" x 13½"
- Machine to cycle (dry run) 8/minute
- Dimensions . . . 146" long - 44" wide - 78" high

For additional specifications or other information contact-

IMPROVED PAPER MACHINERY CORPORATION
PLASTIC MOLDING MACHINERY DIVISION
NASHUA, NEW HAMPSHIRE

should your plastic product have these qualities?

- Flame resistance
- High resistance to water, oil, gasoline
- High permanence on heating
- Excellent electrical properties
- High tensile strength
- High flexibility, even at low temperature
- Low migration

or any combination of the above?

...then you can probably cut plasticizer costs with

MPS®-500

BULLETIN 35 gives you properties of MPS-500; comparisons with other plasticizers; detailed test data; typical formulations and uses. Write today, on your company letterhead, for a copy.

MPS-500 is a stabilized, chlorinated ester of a fatty acid. It shows excellent compatibility with vinyl chloride polymers and copolymers. Its low cost and valuable properties make it well worth investigating, for use alone or with other plasticizers.

• Hooker laboratories are fully equipped to test and evaluate plastic compositions. We are glad to help you solve problems where MPS-500 may be of interest. Your inquiry is invited.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

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NEW YORK, N. Y. • WILMINGTON, CALIF. • TACOMA, WASH.

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CAUSTIC SODA • CHLORINATED PARAFFIN • CHLOROBENZENE • CHLOROTOLUENE • CYCLOHEXANOL • MURIATIC ACID • SULFUR CHLORIDE

Equipped for the molding job ahead

Ideal

The foot-slogging infantryman and the high-flying jet pilot depend on a large variety of plastic items for their well-being and safety. These items, many of them injection molded, will be needed in increasing quantities as the defense program picks up momentum . . . and that's where Ideal Plastics enters the picture.

As the largest, best equipped injection molder in the world, Ideal is Johnny-on-the-spot with everything required to help you meet your defense commitments insofar as molded thermoplastics are concerned. Ideal's 500,000 square foot plant contains facilities for handling every phase of your job . . . from designing your products and engineering your molds to finishing, inspecting and shipping the finished pieces.

With a war-proven record for fine custom injection molding, Ideal Plastics is eager to extend friendly, co-operative service to you. If price, delivery and quality are important—and when aren't they—ask us to submit an estimate. Write or phone. A. C. Manovill, Vice President in Charge of Sales. Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000. Mid-West Representative: Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136.

The basic weapon in Ideal's military molding arsenal is the 8-ounce molding machine. We have 33 of them, plus additional machines of all sizes.

Better Molded Plastics Ideal for Industry & Home

READ THIS CHART

This chart may look silly at first glance—but it really isn't.

This is reserved for tabulating complaints from customers which were not settled to the customer's satisfaction. Of course, we can only be pushed so far before balking—but it's a long way. Our customers feed and clothe us.

We don't guarantee satisfaction—in the plastic molding trade there are too many unknowns even after thirty years—but we make a hell of a pass at it.

We most certainly swallow our own errors and don't do any buck passing.

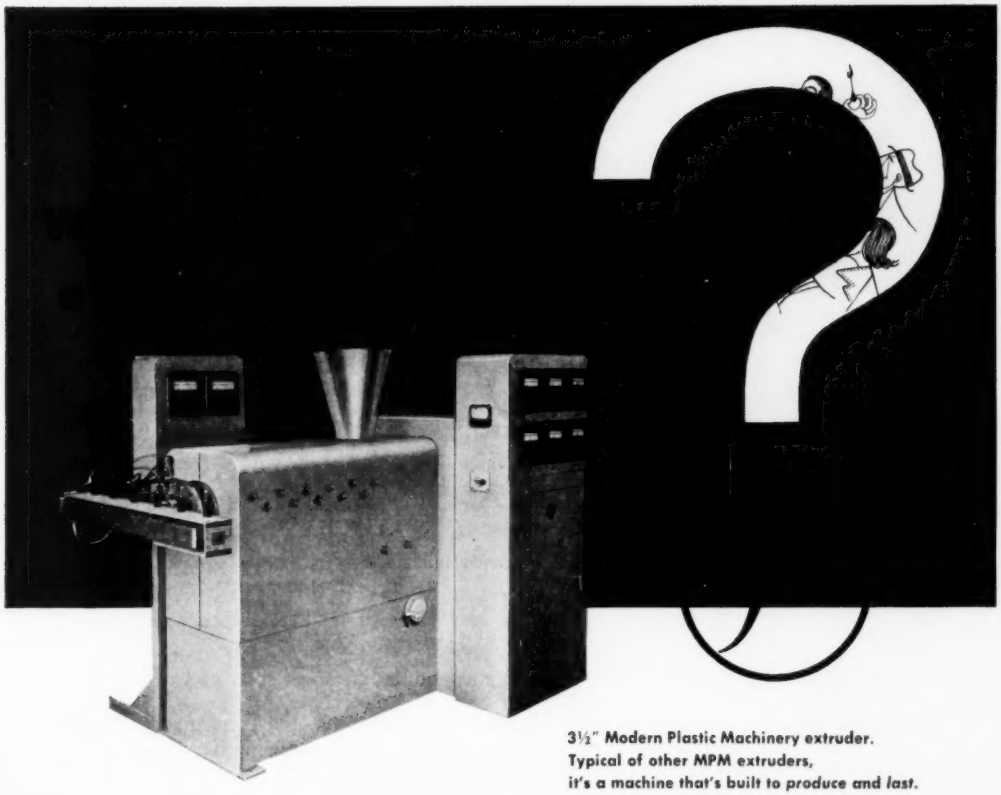
Can this mean something to you in planning your plastic molding?

Let's try.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540



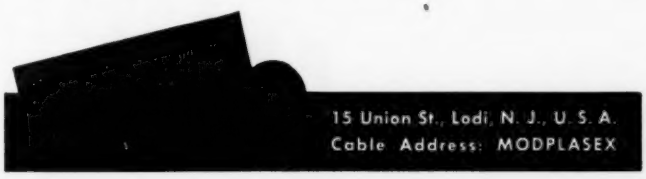
3½" Modern Plastic Machinery extruder. Typical of other MPM extruders, it's a machine that's built to *produce* and *last*.

AT A DEMONSTRATION of a shiny new extruder everybody expects A-1 performance. After all, the machine is brand new, tuned to perfection, working under ideal conditions and operated by factory experts.

But what happens after *you* have been running the extruder for a while? What happens after six months? A year? That's when you really can judge what you've bought. That's when you begin to appreciate the otherwise hidden extras given you by MPM.

Here are a few of the questions which a demonstration can't answer and which you *won't* have to worry about if the extruder you select is an MPM: *Will my extruder be able to extrude new materials with new extrusion characteristics?* The MPM heat control system is so versatile that these machines are used for experimental extrusion work in the development laboratories of nearly every major material supplier. *What about abrasion resistance and internal wearing qualities?* All parts of MPM extruders that contact plastic resins, from hoppers to dieheads, are constructed of solid corrosion and abrasion resistant materials. No platings of hard metals over soft are used; therefore the "wear-through" problem is reduced. *Can my extruder produce a wide range of products?* The combination of MPM's unique heat control, superior die-head and screw design, vari-speed drive and indicating tachometer gives you the widest production range. You can produce precision rods, tubes, cross-sections, covered wire, and wide blown film. The mixing action of the MPM extruder provides an efficient means of compounding and coloring numerous plastic formulations. The MPM pelletizing machine cuts the compounded materials into uniform cylindrical pellets for molding or extrusion.

Of course, there are many pertinent questions about MPM extruders that a visit to our plant *will* answer. Or if you prefer, write for further details.



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WEST COAST PLASTICS DISTRIBUTORS, INC.
2325 Jesse Street, Los Angeles 23, Cal.

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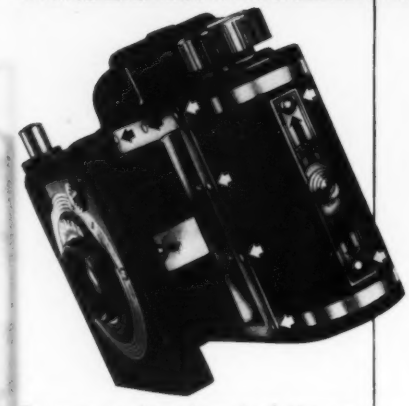
This man can show you . . .

How to eliminate needless operations that slow up assembly hands



Because no tapping or inserts in plastic parts slowed production of this camera, assembly costs were greatly reduced. Sixteen P-K Type U Drive Screws were pressed into blind, untapped holes to assemble sheet metal and Bakelite parts. Two P-K Type Z Screws fasten the periscope extension box.

Type U Hardened Drive Screw, one of five standard types of P-K Screws. For permanent fastenings in castings, heavy gauge sheet metal, and plastics.

Ask a P-K Assembly Engineer to help you "question every fastening". He'll show you where tapping for machine screws, inserts in plastics, and awkward bolting or riveting are wasting time, boosting costs.

His experience is based on more than a million P-K applications. He can quickly determine which Self-tapping Screw, from Parker-Kalon's complete line of *standard* types, will help you make better, faster, stronger assemblies, at lower cost.

Today, more than ever, the P-K Assembly Engineer is a good man to have on your production team, helping you boost output and beat the squeeze on profits. He'll call at your request. Parker-Kalon Corporation, 200 Varick St., New York 14.

Your INDUSTRIAL SUPPLY DISTRIBUTOR . . . *your local source for P-K Screws—works side by side with the P-K Assembly Engineer. Their combined efforts are solving many difficult problems of planning and procurement. Let them help you.*

P-K TRADE MARK REG. U.S. PAT. OFF.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

FOR EVERY METAL AND PLASTIC ASSEMBLY

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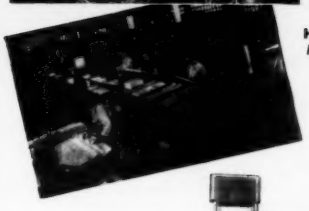
Over HALF A CENTURY

for **AMERICA'S LEADING MOLDERS**

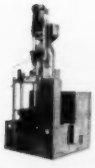


Horizontal Injection Molding Machines—12 to 300 Ounces

Compression Molding Presses — 50 to 1200 Tons.

2 Ounce Semi-Automatic Injection Molding Machines.

Transfer Molding Machines—30 to 1200 Tons.



Vertical Injection Molding Machines — 1, 2, and 6 ounces.

Preform Tableting Machines—10 and 100 Tons.

9-M-23A

Growth and development of plastics molding as an *industry* has so impressively accelerated during the past few years that we are inclined to regard it as a youngster in *technique*. Actually, most current "innovations" in plastics equipment are rooted in experimental work going back more than 50 years to the days of celluloid collars and the first plastic billiard balls . . . to the pioneering days of Watson-Stillman research in what then gave slight promise of becoming the modern giant plastics industry of today.

Throughout its 50 years of leadership in molding equipment manufacture, Watson-Stillman engineering has continued to "call the shots" on new materials, mold design, improved controls and, above all, on larger machine CAPACITY.

For instance, the presently popular "new" trend toward increasing capacity by means of *preplasticing* units was introduced by Watson-Stillman years ago . . . tested, improved, perfected through original research in shop and field by Watson-Stillman engineers . . . and has been successfully employed on Watson-Stillman units from 12 to 300 ounces capacity for years.

Each and every Watson-Stillman Machine is rated for its minimum capacity. This assures a margin of safety in Production . . . W-S Machines *deliver the goods*.

Today, as for more than fifty years past, it will pay you to consult Watson-Stillman *first* when you are molding by compression, transfer and injection techniques or when planning expansion or a new plant.

HYDRAULIC MACHINERY DIVISION

WATSON-STILLMAN

ESTABLISHED 1848

W-S HYDRAULIC

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Branch Office: 228 No. La Salle St., Chicago, Illinois
Manufactured in Canada by—Canadian Vickers, Ltd., Montreal

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W-S "COMPLETELINE" . . . THE SHORTEST DISTANCE FROM PRODUCTION TO PROFIT

A Wide Choice

You'll get it in Pittsburgh Phthalates, too!

If you use phthalate-type plasticizers, you'll profit by a *double benefit* when you specify Pittsburgh PX Plasticizers: First, we have the type of phthalates you're likely to need, including DiButyl, DiOctyl, DiIsoOctyl and several specialty type phthalates. That gives you the advantages of a single source of supply and dependable deliveries.

And second, as a basic and integrated producer of coal chemicals, including naphthalene and phthalic anhydride, we're able to control *quality* from coal to finished plasticizer. This uniformity of quality assures you consistent plasticizer performance and improved characteristics in your finished products.

If you'd like samples or more information about phthalates—or any of the other members of the broad family of Pittsburgh PX Plasticizers, *write today!*

PX-104	DiButyl Phthalate
PX-108	DiIsoOctyl Phthalate
PX-138	DiOctyl Phthalate
PX-208	DiIsoOctyl Adipate
PX-238	DiOctyl Adipate
PX-404	DiButyl Sebacate
PX-408	DiIsoOctyl Sebacate
PX-438	DiOctyl Sebacate
PX-658	TetraHydroFurfuryl Oleate
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WAD 4110

PITTSBURGH COKE & CHEMICAL CO.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

FOR Custom-Moulded TEFLON PARTS LIKE THESE . . .

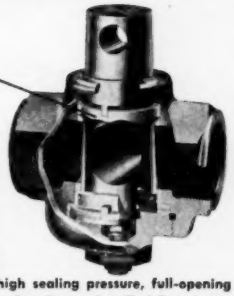
Moulded Teflon liners shown ¾ actual size.

SEE US!

This Teflon valve liner, moulded by Kurz-Kasch for The Duriron Company, Inc., takes full advantage of this most chemically inert of materials. It resists all known acids, alkalis, etc. Nothing known adheres to it. It will withstand a temperature of 500° F. continuously. It has zero water-absorption. It is non-toxic. And its moulded-in wax-like surface permits free turning without lubricants. Inasmuch as Teflon's electrical properties are also outstanding, applications in the chemical, electrical and food processing industries are suggested.

Here's the catch. Teflon cannot be moulded by conventional methods. Some parts are produced by machining, but this has drawbacks where a smooth wax-like surface is required. From the outset, we have worked closely with Durco engineers to produce parts such as these with uniform wall thickness, flange, and taper inside and out by a proved moulding technique. It consists of pressing preforms, sintering at 700° F., and coining.

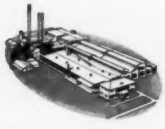
If you're interested in Teflon—or any other thermosetting material—talk to a moulder who has grown up with them. We don't pretend to know all the answers, but we'll honestly, sincerely appraise your problem.



This revolutionary Durco Plug Valve, with its Kurz-Kasch-moulded Teflon liner, realizes to the fullest the astounding characteristics of this new material. It is virtually leak-proof, self-lubricating, and operates with high sealing pressure, full-opening round ports and a high safety factor. It will deliver better performance over longer periods.

Kurz-Kasch

FOR OVER 34 YEARS PLANNERS AND MOULDERS IN PLASTICS



Kurz-Kasch, Incorporated • 1415 South Broadway • Dayton 1, Ohio

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injection molding machines

DE MATTIA

—the standard of MOLDING EFFICIENCY

The De Mattia Model C-1, illustrated, incorporates the ultimate in design and performance in injection molding machines. Exceptionally heavy tension members, high mold clamping pressure and uniform hydraulic pressure on the entire die face are just a few of the many De Mattia features that increase molding efficiency. Like all De Mattia equipment, Model C-1 is ruggedly constructed to provide long service in continuous use—the kind of service that has made the name De Mattia a standard for reliability throughout the industry.

DE MATTIA HORIZONTAL MODEL C-1
SPECIFICATIONS

Material per Injection — 12 ozs. • Plasticized Material per hour — 130 lbs. • Feed Hopper Capacity — 60 lbs. • Injection Piston Diameter — 2¾" • Injection Piston Stroke — 11½" • Hydraulic Injection Cylinder Bore — 13" • Pressure on Material — 22,500 PSI • Mold Closing Pressure — 400 Tons • Max. Mold Size — 18" x 25" • Max. Daylight — 30" • Min. Die Space — 6" • Max. Stroke — 24" • Oil Pump Capacity — 60 GPM @ 1000 PSI, Max. • Motor — 30 HP • Injection Stroke Time, for Filling Mold — 3.0 Secs. • Speed of Injection Piston, Forward — 120" per Min. • Heating Cylinder — 13,000 Watts • Height of Machine, Overall — 72" • Floor Space Required — 172" x 42" • Approx. Weight — 10 Tons.

SEND FOR NEW DE MATTIA CATALOG

It contains complete information and specifications on De Mattia Horizontal and Vertical Molding Machines and De Mattia Scrap Grinders.

MOLDING PRESSES • SCRAP GRINDERS • MOLD MAKING

DE MATTIA MACHINE and TOOL CO.

DE MATTIA MACHINE and TOOL CO.

NEW YORK SALES OFFICE 50 CHURCH ST. — CABLE ADDRESS: BROMACH, N. Y.
MIDWEST SALES OFFICE 189 WEST MADISON ST., CHICAGO 2, ILLINOIS

COLORS

at your fingertips

Rainbow hues, set for action, only a few feet from your plastic mixer.

That's the advantage of dry colorants . . . quick, easy to use, economical . . . and the only practical way to compete in today's market.

Try them! Get free color matches, samples and time-saving tips from Ferro's experienced Color Laboratory. Make your own trial runs, then count your savings.

You cut production time without adding new equipment. You use a minimum of resin by color mixing only the amount needed. Quality of the finished product is excellent. Best of all, you cut your inventory by stocking only clear resins and assorted colors.

You can't afford to ignore dry colorants. And for the best in dry colorants, get in touch with Ferro . . . *today!*

FERRO CORPORATION *Color Division* **4150 East 56th St., Cleveland 5, Ohio**

STURTEVANT DUSTLESS BLENDERS

Thoroughly Blend Substances into an Inseparable Mass

The 4-Way Mixing Action of the Sturtevant Dustless Blenders thoroughly mixes two or more substances into an inseparable whole . . . every part of which is the same analysis. Single receiving and discharging opening insures tight sealing during mixing process. "Open-door" accessibility permits thorough cleaning. The fast, accurate mixing operation increases output . . . cuts mixing costs. Available in many sizes with mixing capacities from $\frac{1}{4}$ ton to 75 tons per hour. Write for information and catalog.

Receiving — The ingredients to be mixed enter the mixing chamber of drums through a chute. Note scoops which carry up and dump the ingredients as drum rotates assuring a more uniform mix.

Discharging — Throwing a lever closes the inlet and mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

The Sturtevant Mill Company

110 Clayton Street, Boston 22, Massachusetts

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

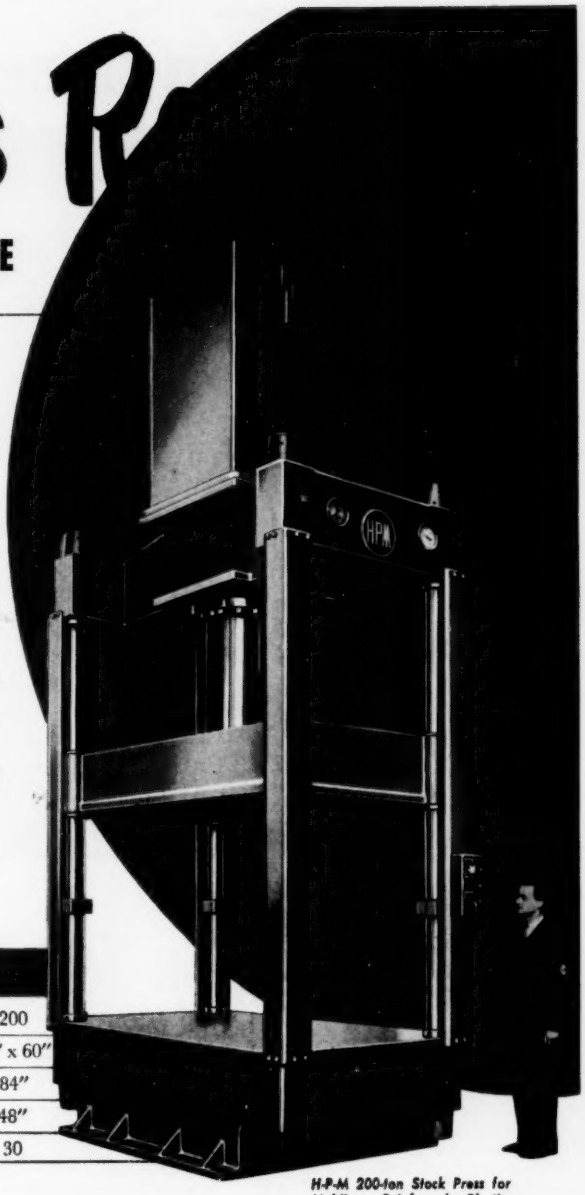
H-P-M's R

with a STANDARD LINE of PRESSES for REINFORCED PLASTICS

Yes, H-P-M has kept pace with the rapid developments in the molding of reinforced plastics! By working closely with Owens-Corning, the firm who developed Fiberglas molding, a stock line of H-P-M presses has been designed to meet the requirements of this new molding industry.

Each press is a self-contained unit, powered by dependable H-P-M built pumps, valves and controls. Semi-automatic control provides fast closing action . . . automatic slow-downs . . . and accurately controlled pressures with press cycles to meet exacting production needs.

Are you planning to use this new "wonder" plastic? If so, write for H-P-M's stock press bulletin No. 5107.



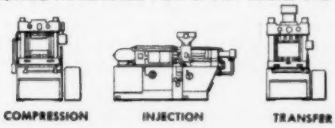
H-P-M 200-ton Stock Press for Molding Reinforced Plastics

SPECIFICATIONS

Tonnage	100	150	200
Mold Size (max.)	48" x 36"	60" x 48"	84" x 60"
Daylight	84"	84"	84"
Stroke	48"	48"	48"
Motor HP	10	10	30

HPM

PLASTICS MACHINES FOR EVERY MOLDING JOB



THE HYDRAULIC PRESS MFG. CO.

1010 MARION RD., MT. GILEAD, OHIO, U. S. A.

Another new development using

B. F. Goodrich Chemical *raw materials*

Data courtesy of Compo Shoe Machinery Corp., Boston, Mass.

Doesn't tread on toes but wears well for years!

THE "toe rubber" pictured here helps thousands of shoes get a good start in life—helps the shoe manufacturer cut costs, too. It's an iron arm, capped with a Hycar rubber-phenolic compound. The cap rests on the toe of the shoe, holds it in place while a platform is attached to the sole.

Most important—the toe rubber must not scratch or mar the leather. Yet it must have good abrasion resistance for long service to keep production going without costly interruptions.

That's just where Hycar fills the bill perfectly. The cap surface is so smooth that it won't mar the finest leather. Yet it is so abrasion-resistant that it lasts for several years. Compare that service with a standard rubber cap—which lasts less than two months!

Hycar-phenolic compounds have many advantages that help designers and molders in many cost-saving ways. They impart extra toughness and shock-resistance to molded parts. In processing, they provide better molding characteristics . . . easier flow in the mold than straight phenolics . . . resistance to cracking around metal inserts in the part.

A Hycar rubber compound may help you improve a product or solve a problem. For versatile Hycar is used as a base material . . . as a modifier for phenolic resins . . . as an adhesive base . . . as a latex for coating or impregnating. For technical bulletins and advice, please write Dept. HU-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Manufacturers of phenolic thermosetting molding compounds and phenolic synthetic resins for the electrical, transportation, home appliance, paper and pulp, protective coating and foundry industries.

Dry granular phenolic thermosetting molding compounds are produced in blacks, browns, mottles and colors in general purpose, heat-resisting and medium impact grades. Special purpose molding compounds are produced to fulfill special molding requirements.

Synthetic resins are produced in dry, lump and finely ground particle size or in solution adaptable to customer's requirements. Technical service is extended and inquiries are invited.

PLEN PHENOLICS

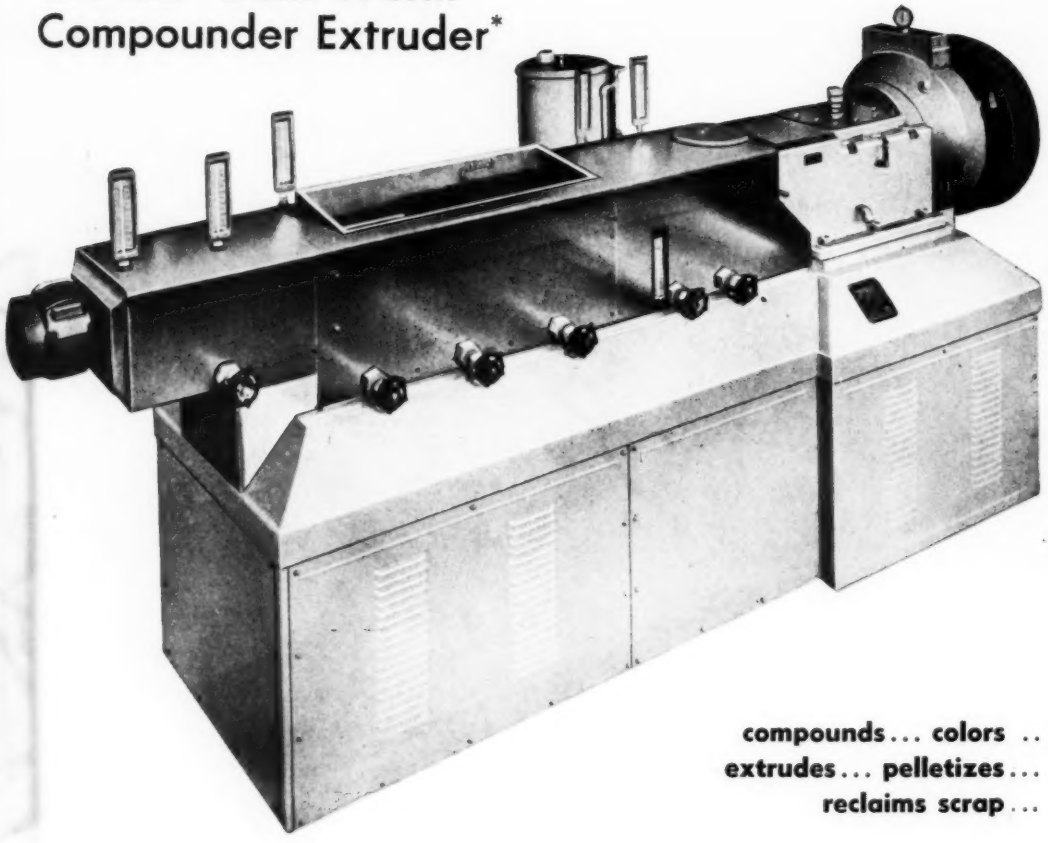
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

DO 5 JOBS ON THIS 1 MACHINE!

It's the "Dual Worm" Compounder Extruder*



compounds... colors ..
extrudes... pelletizes...
reclaims scrap...

HERE is an extruding machine to slash your production costs by doing the work of five separate kinds of equipment.

The patented interacting "Dual Worms" that operate in a "pressurized" cylinder provide the explanation. They generate so much power, work so fast and knead so thoroughly that they're able to perform functions beyond the capacity of most conventional extruders.

Operation of the machine is simple and almost entirely automatic except for feeding raw materials or scrap into the hopper.

The "Dual Worm" Compounder Extruder is available with 2" worms—output approximately 100 pounds per hour. Larger, higher capacity units are in prospect.

Write today for prices and free descriptive brochure.

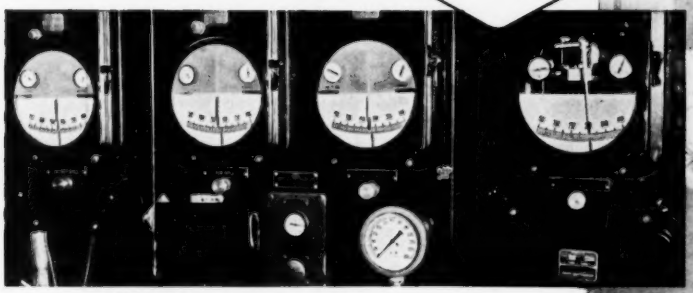
SMART & BROWN (Machine Tools) LTD.

24, 25, Manchester Square, London W. 1, England

Telephone: Welbeck 7941 Cables: Smartool, Wesdo, London

* By agreement with Messrs. WELDING ENGINEERS, Norristown, Pennsylvania, U.S.A., Smart & Brown (Machine Tools) Ltd. are the licensed manufacturers in England of 2" "Dual Worm" Compounder Extruders. They are also the sole distributors for all countries except North America. Local agents are being appointed.

Process at temperatures from 20° to 40° lower with PLIOVIC



HERE'S PROOF—close-up of thermometers showing actual calendering temperatures used in processing PLIOVIC—20-40 degrees less than those used with comparable resins.

USE PROVED *Products*

WHEN you process with PLIOVIC—Goodyear's unique, high molecular weight vinyl copolymer—you can operate at from 20° to 40° lower temperature than with resins of comparable physical properties, whether you are using mills, calenders or extruders.

In addition to the processing advantage this brings you, you can load PLIOVIC with extenders with less sacrifice of physical properties—making for economy. PLIOVIC needs less of costly and scarce plasticizers, yet gives you high-strength properties, toughness at low temperatures, good heat stability, good light stability, high resistance to flex-fatigue and excellent chemical resistance.

Films made with PLIOVIC have excellent "hand" and drape. Other current uses include flooring, hose, tubing, molded items, and organosols, for unsupported film and for fabric and paper coatings. Ask for further details, and sample for your own evaluation by writing today to:

GOODYEAR, CHEMICAL DIVISION
AKRON 16, OHIO

GOODYEAR

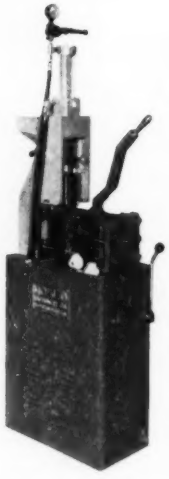
We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

Pliovic—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MOSLO

HC-75

Minijector



For Die-Tryout or Molding Small Parts

The Moslo Minijector Model No. HC-75 is ideal for molding such small parts as buttons, novelty items, etc. It is equally valuable for die tryout and in dental laboratories for molding dentures. This completely self-contained molding machine will mold all thermoplastics and features a hydraulic system for injection, with a toggle clamp that is mechanically operated and designed to provide maximum clamping pressure. A simplified knock-out plate removes molded parts and a built-in chute discharges the finished part.

SPECIFICATIONS

Injection Capacity per Shot	¾ oz.
Mold Size	6" x 5" x 5"
Maximum Casting Area	6 sq. in.

We invite your inquiry, write for details.

PROMPT DELIVERY

Moslo Enterprises

MOSLO MACHINERY COMPANY
2443 PROSPECT AVENUE · CLEVELAND 15, OHIO

Tested and Proven

accepted names

in the dry coloring field

Mid-America Plastics, Inc., in full production capacity, is supplying the industry with dry colorants. Our completely equipped laboratory and modern manufacturing facilities is formulating and compounding "Colorblende" the dry colorant, and "Dispersa" the wetting agent. You can get immediate delivery of "Colorblende" in 17 Bureau of Standards colors or specify any special colors.

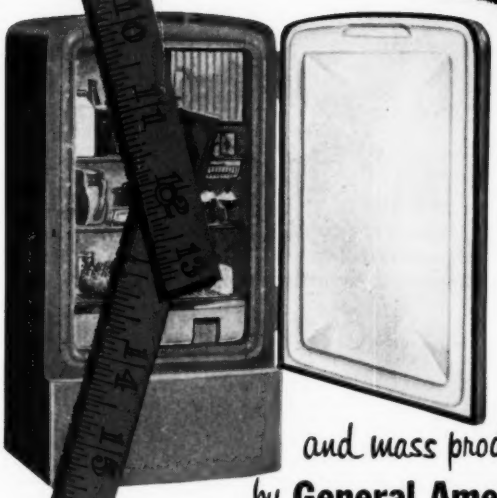
We invite your inquiry—write today for our price list and Color Comparison Chart. Upon request we will send without charge a sample of any standard color of your choice. "Colorblende" and "Dispersa" are packaged in convenient containers—in 50# or 100# units ready to color your crystal styrene in any mixing drum.

Quick—Easy—Dust Free—Economical

TERRITORIES OPEN FOR DISTRIBUTORS

MID-AMERICA PLASTICS, INC.
COLOR DIVISION
2443 PROSPECT AVE. · CLEVELAND 15, OHIO

take a look at one of the biggest "single-shot" injection moldings ever produced!



and mass produced by General American

Here's another example of how General American can consistently turn out skillful, high quality moldings to meet production schedules. The big reason is the *completeness* of General American's facilities. Injection presses range in size up to 300-oz. capacities; and compression up to 2000 tons. Large moldings or small, idea or design, problem job or relatively easy . . . General American handles *every phase* of producing parts or products of plastics in one of the largest, most modern and well equipped plastic producing plants in the country. Write for new brochure describing General American's facilities.

31 by 48 inches . . . an inside door panel General American is starting to mold for one of the country's leading refrigerator manufacturers. All done in one operation, in one single injection on a 300-oz. press.

Holds its shape . . . No temperature or moisture distortion! A serious complaint *before* General American tackled the problem. Panel won't cringe, shiver or buckle from cold or anything else.

No chipping, checking, shattering . . . Very tough. Flexible enough to be actually bent almost in half . . . High tensile strength with plenty of freedom for the manufacturer's designers to put in extra contours or additional modern, flowing lines of design.

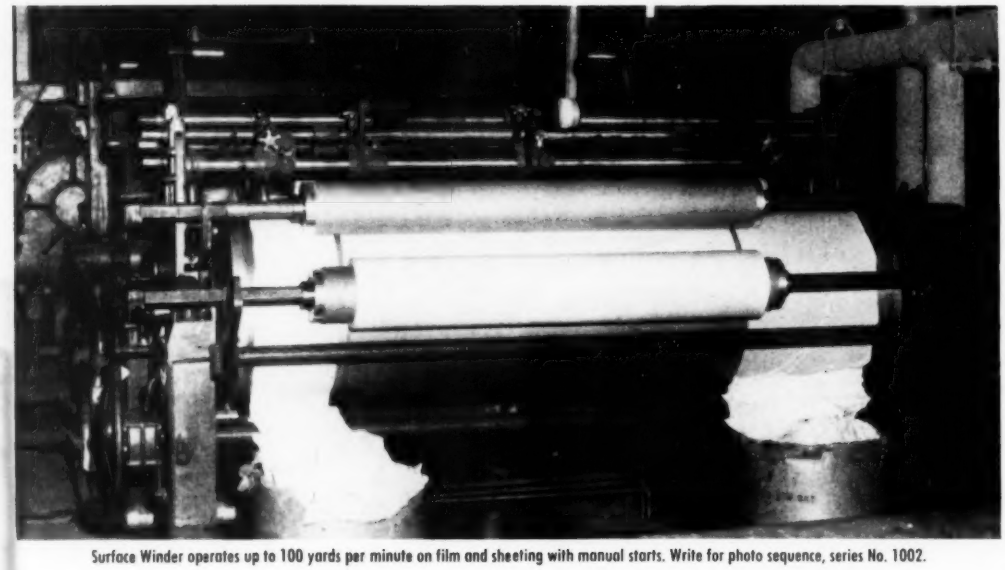
Smooth, colorful uniformity . . . Where appearance counts . . . this panel has a high score. It has a smooth, sparkling surface with gleaming white molded in. Pigment is incorporated clear through. It's easy to clean, won't stain, won't discolor . . . it's made the way Mrs. Housewife wants it!

PLASTICS DIVISION
GENERAL AMERICAN
TRADE MARK

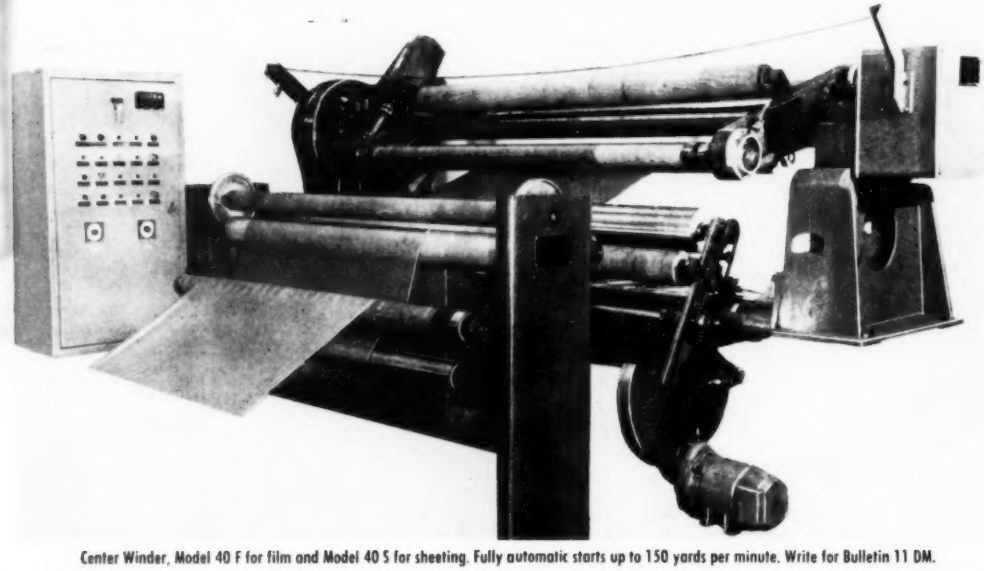
PLASTICS DIVISION
General American Transportation Corporation
135 South LaSalle Street, Chicago 90, Illinois
New York 17: 10 East 49th Street • Detroit 2: 2842 West Grand Boulevard

General American has had more than 50 years of successful experience in manufacturing for America's largest companies.

plastic winders



Surface Winder operates up to 100 yards per minute on film and sheeting with manual starts. Write for photo sequence, series No. 1002.



Center Winder, Model 40 F for film and Model 40 S for sheeting. Fully automatic starts up to 150 yards per minute. Write for Bulletin 11 DM.

Dilts

DILTS MACHINE WORKS
DIVISION OF THE BLACK-CLAWSON COMPANY
Fulton, New York

To men dissatisfied with their packages

If your present package is not delivering all you want in the way of merchandising and product protection, let us tell you what you can do with packaging materials plasticized with Monsanto Santicizer 141, Santicizer E-15 or Santicizer B-16.

These plasticizers have been accepted as nontoxic by the Bureau of Animal Industry of the United States Department of Agriculture. That means that they are safe to use in packages for foods.

Santicizers 141, E-15 and B-16 are compatible with a variety of resins used to make packaging film, including polyvinyl chloride and copolymers, cellulosic resins, rubber-based resins—in fact nearly all commercially available film-forming materials.

By choosing from these plasticizers, you can achieve packages that are clear, odorless, tasteless . . . that are strong and tough . . . that resist moisture and retain flexibility at low temperature.

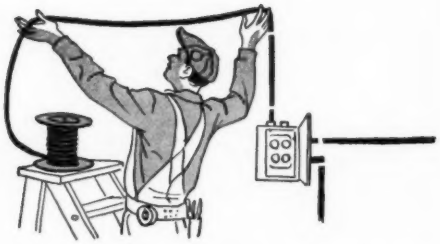
For data on these and other Monsanto Plasticizers, and for technical assistance, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Santicizer: Reg. U. S. Pat. Off.

SANTICIZER

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND



You get all 3 with "Dutch Boy"

TRIBASE E (vinyl insulation stabilizer)

1. Good Electrical Properties. Tribase E provides all of the electrical advantages characteristic of lead silicates, without sacrificing great heat stability.

2. Exceptional Heat Stability. Tribase E's safe, high, available basic lead content guarantees good, long time heat stability. It also eliminates gassing and other types of stabilizer breakdown.

3. Low Volume Cost. Tribase E has a low specific gravity ... making it the most economical "White Litharge" type compound available.

If you have a vinyl electrical insulation problem, consult our technical staff. And if you'd like more information and technical data about Tribase E, a request will be welcome.

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols. Exceptional weathering characteristics
NORMASAL (Normal Lead Salicylate)	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Dutch Boy* CHEMICALS

*Reg. U. S. Pat. Off.

NATIONAL LEAD COMPANY

111 Broadway, New York 6, N. Y.

NEW PHENOLIC *with minimum impact strength of 1.05* that can be automatically preformed*

**1.05 ft. (min.) lbs./in. of notch*

Here at last is a high impact phenolic molding compound that is almost as easy to preform and mold as general purpose materials. This new material, like other Rogers impact phenolics, is formulated specifically to facilitate high speed production of high strength molded parts.

Preforms can be made on standard tabletting machines and the "pills" are not only hard but can be held to close weight tolerances. This ready preformability of RX 431 permits electronic preheating when desired for improving electrical characteristics and shortening molding cycles.

Clean and dustless, this new material is pleasant as well as easy for personnel to handle. Its molded appearance rates as good.

Complete specifications for RX 431 are available on request. Please write Dept. P, Rogers Corporation, Manchester, Conn.

Better Parts for Better Products

ROGERS
CORPORATION
Established in 1832

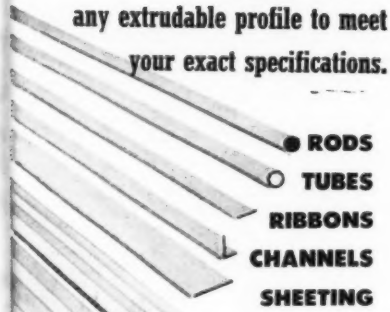
Challenge Clopay Plastics to do your job!

Clopay research has made revolutionary progress in the development of precision plastics with material characteristics of the widest versatility.

Clopay facilities and new compounding techniques offer new opportunities in the engineering of

POLYVINYL CHLORIDE
ACETATE
POLYSTYRENE
ACETATE-BUTYRATE
ACRYLICS
HIGH-IMPACT
HIGH STYRENE COPOLYMERS

Thermoplastics in any extrudable profile to meet your exact specifications.



- **RODS**
- **TUBES**
- **RIBBONS**
- **CHANNELS**
- **SHEETING**

Round, flat or unusual shapes in a complete range of colors . . . low and high temperature properties . . . hard or soft with required degree of toughness and dielectric strength to meet the most exacting specifications . . . any combination to satisfy difficult requirements for gaskets, mouldings, tubing, electrical insulation and other uses. Clopay Vinyl extrusions are an authentic improvement over rubbers (natural or synthetic) not a substitute.

For specific information write, wire, or phone . . .
INDUSTRIAL PRODUCTS DIVISION

CLOPAY corporation

Clopay Square, Cincinnati 14, Ohio
Phone: DUnbar 4800

New York: 386 Fourth Avenue, Room 608
Murray Hill 3-8066
Detroit: 814 Fisher Building—TRinity 1-4262

CHECK THESE CLOPAY SERVICES

☐ **1.** Fabrication of Vinyl film, supported and unsupported, and Polyethylene film for specialized uses.

☐ **2.** Vinyl coating and embossing of papers and textiles.

☐ **3.** Multi-color printing (surface and rotogravure) for decorative uses and military wrapping and packaging.

☐ **4.** Precision fabrication of extruded and molded parts.

☐ **5.** Precision slitting, electric-eye controlled cutting, die-cutting, electronic and thermal sealing, and high speed production line sewing of plastics.

☐ **6.** Manufacture of cast Vinyl film for applications where uniform high strength and dielectric properties are required.

☐ **7.** Complete Laboratory and Engineering facilities for research and development.

Farrel-Birmingham is prepared to engineer a mill with any combination of design features and attachments necessary to fill your needs. Physical proportions, method of heating or cooling the rolls, gauge control, prevention of stock contamination — in fact, every detail of construction can be worked out to fit your requirements.

Furthermore, almost any "special" mill can be furnished from existing drawings and patterns — because, in a century of building processing machinery, Farrel-Birmingham has designed mills for almost every conceivable application. This means that, ordinarily, you can obtain the exact mill you require in a design that has been proved in service.

FB-691

IMAGINE MAKING only 10,000 OF THESE

and a profit, too?

RADIO CASE made of Boltaron — the tough, new low-pressure formable sheet.

Any experienced plastics fabricator can do it for you by taking advantage of the low-cost molding methods that Boltaron makes possible.

Formability — Any simple or complex shape can be formed in Boltaron with low-cost molds and molding equipment.

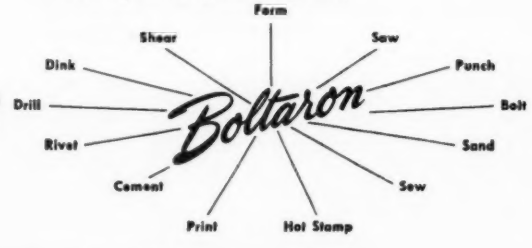
Impact Resistance — Boltaron is unharmed by blows that dent sheet metal, shatter metal castings. Boltaron tote boxes (any shape or size) can be dropped from a second story window . . . last indefinitely.

Other Features — Boltaron can be produced in any color and in several finishes. Colors are an integral part of the Boltaron sheet, won't peel, chip, crack, or scrape off. For further details write for illustrated booklet to

BOLTA, Box 305, Lawrence, Mass.

USES

OFFICE MACHINE HOUSINGS
ADV. & DISPLAY SIGNS
AIRPLANE AND AUTO TRIM
FENDER GUARDS
PACKAGING
TOTE BOXES
LUGGAGE
INSTRUMENT PANELS



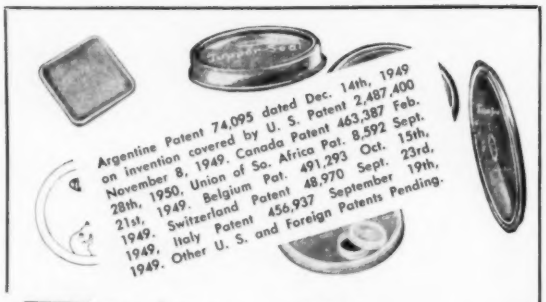
Boltaron A BOLTA Plastic

NEW! Boltaron 6200, a plastic of remarkable chemical resistance, is available through H. N. Hartwell & Son, 947 Park Square Building, Boston, Massachusetts.

NOTE: Our Custom Molding Division specializes in injection and compression molding of all types. Write direct to Custom Molding Division, BOLTA, Lawrence, Massachusetts.


AETNA-STANDARD BUYS RUBBER AND PLASTICS DIVISION OF NATIONAL-ERIE
E. E. Swartswelter, President of The Aetna-Standard Engineering Company, Pittsburgh, Pa., announces the purchase of the rubber and plastics machinery division of the National-Erie Corporation, Erie, Pa., a subsidiary of Bucyrus-Erie Company.
The purchase includes the drawings, patents and records.
Aetna-Standard will manufacture a complete line of rubber and plastics machinery in their large, well equipped plant at Warren, Ohio. Sales and design engineering will be handled by Hale & Kullgren, Inc., Akron, Ohio.
In the ferrous and non-ferrous industries, Aetna-Standard is well known for continuous butt weld pipe mills, seamless tube mills, continuous coating lines, flat-rolled equipment and drawbenches. The company has also been active in the rubber machinery field as a rebuilder of Banbury Mixers and in the development of heavy basic machinery.
The company will take over many of the orders on National-Erie's books and will solicit new orders through Hale & Kullgren, Inc.
PRODUCTS
MILLS • WASHERS • CRACKERS • SHEETERS • REFINERS • EXTRUDERS • STRAINERS • INSULATORS • BANBURY MIXERS • HYDRAULIC PLATEN PRESSES • HORIZONTAL VULCANIZERS • DEVULCANIZERS • SIMPLEX QUICK OPENING DOORS • SPECIAL MACHINERY
HALE & KULLGREN, INC., HANDLE SALES
The well known firm of (Andy) Hale & (Gil) Kullgren, Inc., Akron, Ohio, will continue to handle the sales, design engineering and development work for Aetna-Standard. The engineering and sales personnel of National-Erie will join Hale & Kullgren in Akron, Ohio.
Sales Distributors and Designers
HALE & KULLGREN, INC., Akron
50 YEARS OF CREATIVE ENGINEERING
Aetna-Standard has a long and enviable record in the business of engineering and manufacturing machinery for the ferrous and non-ferrous industries. They have two large, well equipped plants and are now completing a major expansion program to provide the best facilities for producing production machinery.
Aetna-Standard
THE AETNA-STANDARD ENGINEERING COMPANY • PITTSBURGH, PA.
Plants in Warren, Ohio • Ellwood City, P vania

Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.



Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Other U. S. and Foreign Patents Pending.

TUPPER! Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER!

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

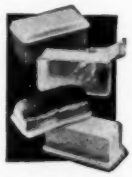
TUPPER CORPORATION

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Por Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

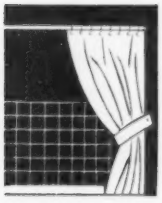
TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

FACTORIES: Farnumsville, Mass., and Cuero, Texas **New York Show Rooms 225 Fifth Ave.**

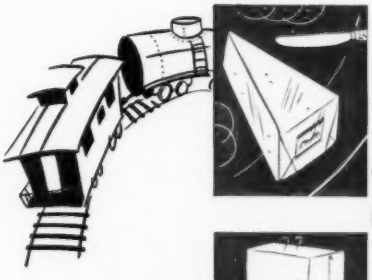
ADDRESS ALL COMMUNICATIONS TO: Department M-4

An Ideal Travelling Companion for VINYLS



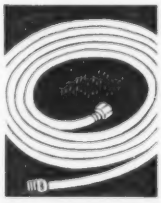
ACETYL TRIBUTYL CITRATE

A NON-TOXIC PLASTICIZER



CONSIDER THESE QUALITIES WHICH MAKE ACETYL TRIBUTYL CITRATE A HIGHLY DESIRABLE PLASTICIZER FOR VINYL SHEETING, FILM, AND EXTRUSION COMPOUNDS:

- NON-TOXIC
- LOW VOLATILITY
- SUPERIOR LIGHT and HEAT STABILITY
- HIGH COMPATIBILITY



Acetyl Tributyl Citrate is a clear, water-white liquid, soluble in most organic solvents. It has a high boiling point—172-4°C at 1 mm Hg—and is insoluble in water. This plasticizer is highly compatible with vinyl polymers and copolymers. In vinyl compounds, its use results in improved heat and light stability. Extensive tests have proved it to have a very low order of toxicity, making it ideal as a plasticizer for food packaging material.

For additional information about Acetyl Tributyl Citrate and other Pfizer Citrate Plasticizers write for the booklet "Pfizer Citric Acid Esters as Plasticizers."

CHAS. PFIZER & CO., INC.

630 Flushing Ave., Brooklyn 6, N. Y.

Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.

Manufacturing Chemists for Over 100 Years

PFIZER QUALITY ® PFIZER

You can do more with PLASTICS by coming to PLAX

PLAX HAS MORE METHODS TO DO MORE THINGS WITH PLASTICS

	BLOWING		EXTRUSION				FABRICATING	MOLDING	
	SIZE 1/8 OZ.–PT.	SIZE QT.–13 GAL.	ROD	SHEET	TUBE	FILM	MACHINED PARTS	INJECTION	COMPRESSION
POLYETHYLENE	✓	✓	✓	✓	✓	✓	✓	✓	✓
POLYSTYRENE	✓		✓	✓	✓	✓	✓	✓	✓
KEL-F			✓	✓	✓		✓	✓	✓
METHACRYLATE			✓	✓	✓		✓	✓	
CELLULOSE ACETATE BUTYRATE	✓		✓	✓	✓		✓	✓	
CELLULOSE ACETATE	✓	✓	✓		✓		✓	✓	
ETHYL CELLULOSE	✓		✓		✓		✓	✓	

if it's Thermoplastic— see PLAX first

Plax has the know-how to simplify the task of applying plastics to your product—as improvements, not substitutes—whether for civilian or military use. On defense work, we offer a background of extensive experience, gained by supplying on more than 5,000 prime contracts in World War II.

We offer, too, the advanced outlook of constant research and development. Our blow-molding techniques have widened the use of one-piece bottles and similar industrial shapes.

Our oriented Polyflex sheet provides the outstanding electrical properties of polystyrene plus high strength and improved fabricating characteristics.

NEW CATALOG AVAILABLE

Describes— Plax Products, Materials, Facilities, and Services.

YOURS, ON REQUEST

PLAX CORPORATION

Subsidiary of Emhart Mfg. Co.

P. O. BOX 1019, HARTFORD 1, CONNECTICUT

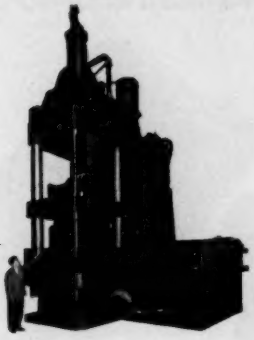
In Canada, Plax Canada, Ltd., Toronto—Sales Offices: New York City, Syracuse, Philadelphia, Cincinnati and Chicago.

checkmate plastic molding problems

with the JACKSON & CHURCH pre-plasticizing press engineered especially for your needs

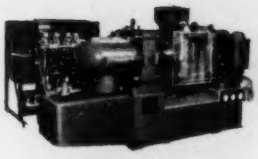
200 oz

Capacity 1000 lbs. of styrene per hour on a continuing basis. Makes possible the molding of larger and heavier plastic products. Potential capacity: 300 oz. at 45 second cycle with substitution of 300 oz. chamber. 2000 tons locking pressure.



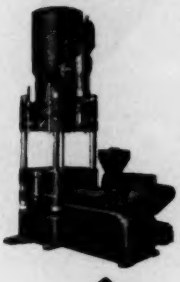
6 oz

Newest J-C press. Plasticizes 160 lbs. of styrene per hour. Produces 150 sq. in. projected area* . . .



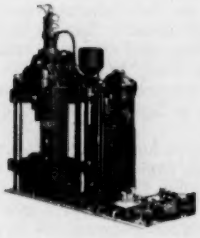
16 oz

J-C horizontal press plasticizes 180 lbs. of styrene per hour with pressure exerted on the material in the injection chamber of 14,000 p.s.i. Locking pressure on the clamp is 250 tons.



48 oz

Shoots 500 sq. in. of projected area* in fast cycles. Versatile, all-in-one press operates at lower injection pressures for substantial weight savings. Shots can be made in 30 sec. cycles from 48 oz. to 6 oz. Has coloring advantages of larger presses. Locking pressure on clamp is 500 tons.



6 oz. (cont.)

9 second cycle . . . 180 tons locking pressure. Complete plug-in of all electric controls.

** Dependent upon part design, mold design & material

Vanclor PRE-PLASTICIZING PROCESS JACKSON & CHURCH CO. Saginaw Michigan

A PRODUCT OF

JACKSON & CHURCH CO. • SAGINAW, MICHIGAN

WORK WELL DONE SINCE '81

How to avoid complications on complicated *molding* jobs . . .

bring them to *Erie*

a pioneer in custom molded plastics

There are six pieces in this simple-looking military flashlight molded for Niagara Searchlight Corporation, Buffalo, N. Y. There are 5 male and 4 female threads. And there's the very intricate design of the "throat."

It's the sort of job that Erie Resistor likes. It requires precision accuracy . . . threads must be clean and sharp . . . assembly must be fast, on the assembly line or the firing line . . . individual parts must be exactly uniform, freely interchangeable. The complexity of the L-shaped tube and "throat" called for a high degree of ingenuity in die design and molding technique.

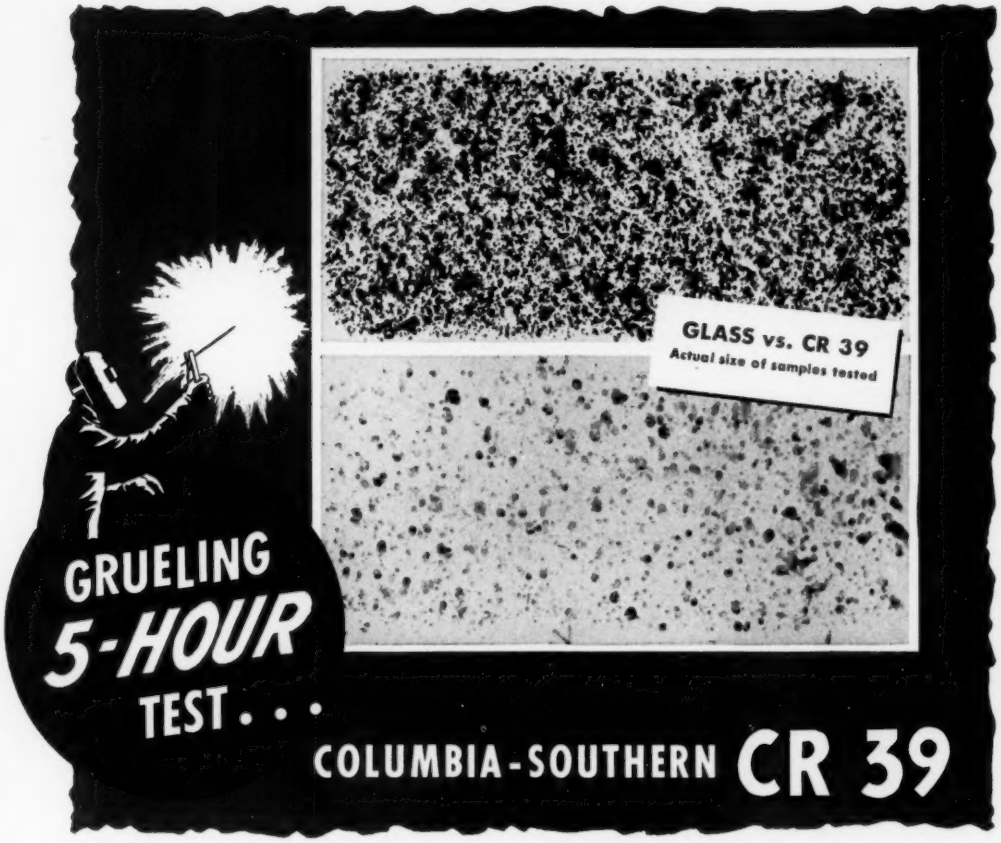
Erie Resistor has the facilities for any possible custom injection molding job. Twenty-three presses, from 2 ounce to 60 ounce capacity, and complementary up-to-the-minute finishing equipment provide an unusual potential of versatility and economy of production. And facilities are utilized by a personnel of long experience in tackling and solving the tough problems of injection molding.

Plastics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND . . . TORONTO, CANADA

Cliffside, N. J. • Philadelphia, Pa. • Buffalo, N. Y. • Chicago, Ill.
Detroit, Mich. • Cincinnati, Ohio • Los Angeles, Calif.



The unretouched photographs above show the results of welders' helmet cover plates, one of glass, the other of CR 39, when subjected under identical conditions to a 5 hour overhead welding test.

Examination of the CR 39 plate revealed spots of only slight discoloration. The plate retained good optical clarity. There was no pitting or warping and there was a complete absence of crazing.

Conversely, however, the glass panel showed very poor optical clarity or light transmission, the surface was badly pitted, metal granules adhered to and covered the exposed area, and the glass was cracked in 5 places.

In addition to having favorable thermosetting properties and good resistance to plastic flow at elevated temperatures, other tests have shown Columbia-Southern CR 39 to be exceptionally resistant to abrasion, crazing, chemical and solvent attack, distortion, weather and shock.

The properties of CR 39 therefore make it extremely advantageous for welders' helmets, safety goggles, radio and aircraft instrument panels, industrial crane enclosures, watch crystals, rear lights for convertible tops and numerous other commercial and military uses.

Samples of CR 39 and further information will be furnished gladly on request. Write Columbia-Southern Chemical Corporation, Fifth Avenue at Bellefield, Pittsburgh 13, Pa.

*

CR 39, as furnished by Columbia-Southern, is a clear, colorless, water insoluble organic liquid of low viscosity.

CR 39 is available in transparent cast sheets of various standard or custom sizes, or in finished objects, from:

HOMALITE CORPORATION
11-13 Brookside Drive
Wilmington 166, Delaware

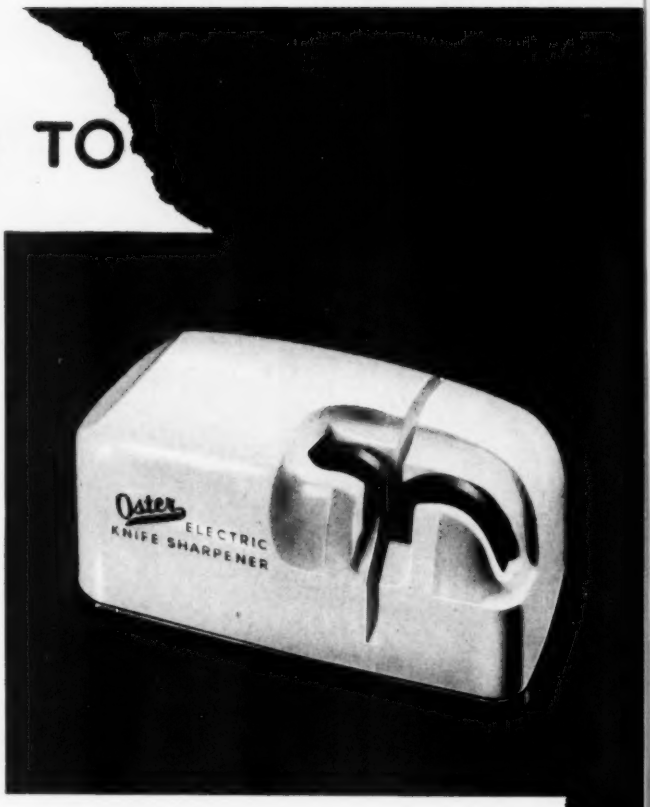
CAST OPTICS CORPORATION
1 Post Road
Riverside, Connecticut

OPTICAL PLASTICS CORPORATION
69 Southfield Street
Stamford, Connecticut

COLUMBIA-SOUTHERN
CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
FIFTH AVE. AT BELLEFIELD · PITTSBURGH 13, PA.

DISTRICT OFFICES: **BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • HOUSTON • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ST. LOUIS**

DESIGNED TO



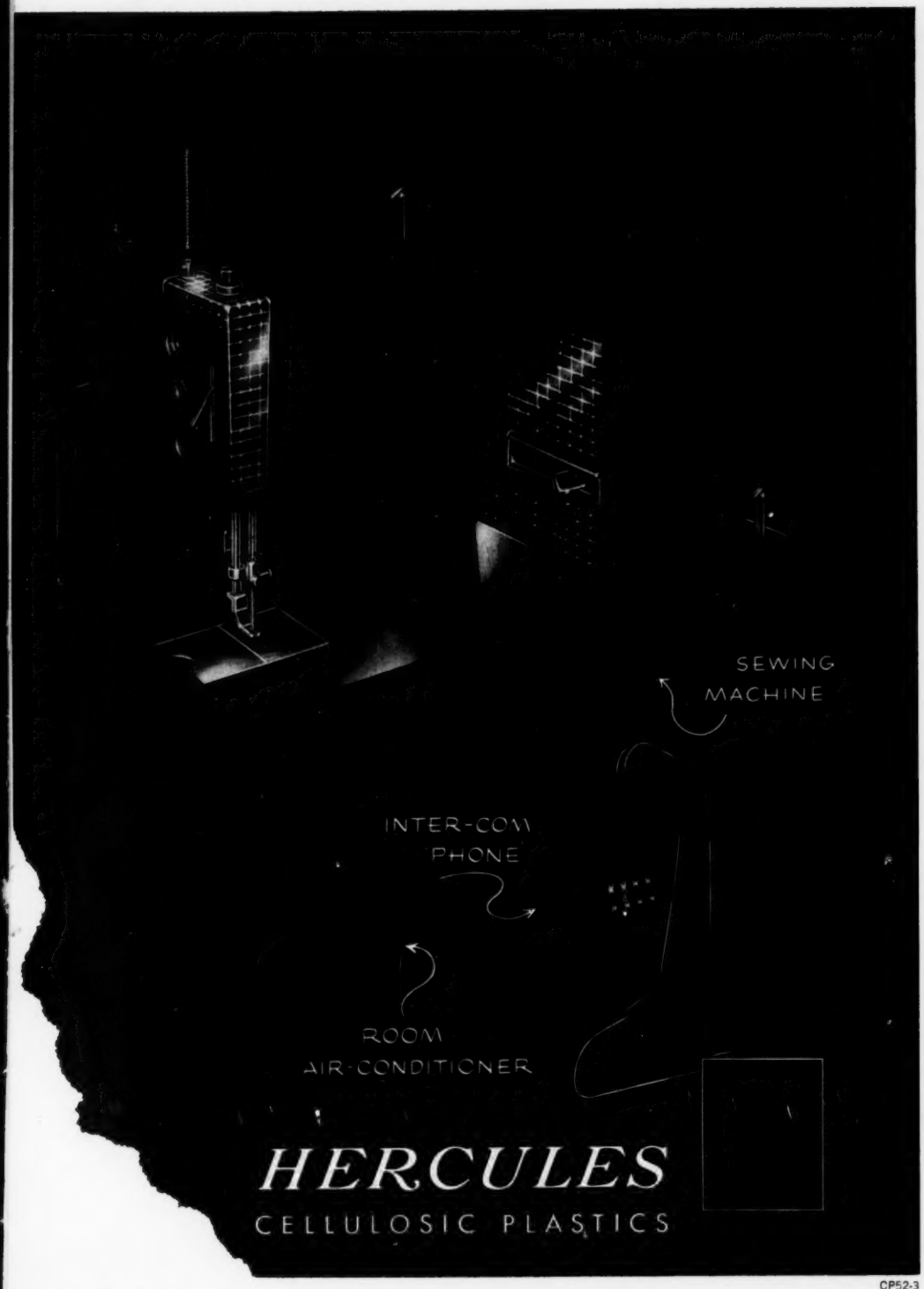
TODAY: *Look what the right plastic, combined with good design can do! With a gleaming white housing molded of Hercocel A®, the new Oster electric knife sharpener looks better, works better . . . has already become a best seller. Its through-and-through color and lustrous finish won't chip, peel, or wear off . . . they resist kitchen oils and greases. This handsomely styled and durable housing has a toughness and strength that spell a long and satisfactory service life.*

TOMORROW: The unique combination of plus properties provided by the Hercocel plastics points to their successful use in the manufacture of durable and attractive housings of many types. Our designer suggests in the sketches shown here examples of products that might readily benefit from the advantages offered by these versatile materials. The right use of Hercocel yields parts with new eye-interest and sales-appeal, improved performance, and very often will reduce costs in manufacturing, assembly, and shipment.

All the Hercules services offered to the users of our plastics materials, including design assistance, technical counsel, and the facilities of our laboratories, are geared to help Hercocel help *you*. We invite your inquiries.

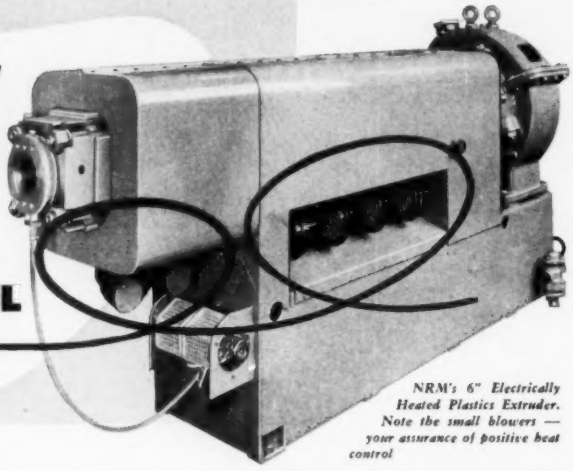
HERCULES POWDER COMPANY
INCORPORATED
Cellulose Products Department, 916 Market Street, Wilmington, Delaware

Original designs for sewing machine, inter-com phone, and room air-conditioner by Sundberg-Ferar, Detroit, Michigan.


SEWING
MACHINE
INTER-COM
PHONE
ROOM
AIR-CONDITIONER
HERCULES
CELLULOSIC PLASTICS

for "close tolerance" plastics extrusions . . .

You Need BALANCED HEAT CONTROL



NRM's 6" Electrically Heated Plastics Extruder. Note the small blowers — your assurance of positive heat control

Getting "close tolerance" extrusions depends on eliminating "pulsation" at the die head. Eliminating "pulsation" depends principally on positive heat control. Positive heat control is easily obtained with NRM's exclusive "Balanced Heat Control" system.

In electrically heated extruders, NRM incorporates "Balanced Heat Control" to assure absolute control over frictional heat — to prevent excessive compound heat, the major cause of pulsating, uneven extrusions.

Basically, the problem is one of heat inertia and heat dissipation. The heater control shuts off the current supply, but not the heat of the heater. The extra, undesirable heat must be removed. Since it cannot be dissipated through the heaters, this extra heat is absorbed by the cylinder wall. But, the cylinder wall must be kept sufficiently cool to absorb any excessive compound heat. Thus, heat must be directly dissipated from the cylinder wall.

NRM uses air — at room temperature and pressure and in high volume — to remove the heat from the cylinder wall. Small blowers force cool air through deep, narrow, annular slots in the cylinder wall and exhaust heat-laden air through the top slot formed by the halves of the shell. The annular slots are of the inverted fin type which do not delay the conduction of heat from the band heaters during heating, yet provide the maximum area for the radiation of heat during cooling. The high volume of air cools the cylinder wall quickly and evenly, permitting rapid dissipation of both frictional and inertial heat.

"Balanced Heat Control" is an exclusive NRM feature. It's fast, simple, highly efficient and most economical in operation. It's completely self-contained — requires no external connections to air, water, oil, or steam lines. It provides sufficient cooling for "shut-down". It is the only absolute answer to positive heat control — to uniform extrusions.

But, "Balanced Heat Control" is just one of the many features of NRM extruders — features developed through sound engineering and long experience to give you increased quality at decreased costs. Write to the experts at NRM, today! Let them help you improve your extruded product and profit pictures.

In case you didn't get a copy of NRM's new booklet, "19 Steps to Better Extrusions", at the Plastics Show, write for one today. You'll find it interesting and informative.

2013

NATIONAL RUBBER MACHINERY COMPANY

NRM

Creative Engineering

General Offices & Engineering Laboratories: Akron 8, Ohio

East: 1180 Raymond Blvd., Newark, N. J.

West: S. M. Kipp, Box 441, Pasadena 18, Cal.

Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

Gering

...ered TO SERVE THE ENTIRE PLASTICS INDUSTRY

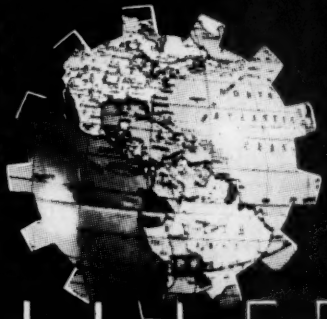
a complete **PLANT**

for a complete **SERVICE**

WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.

- WE BUY THERMOPLASTIC SCRAP — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
- WE CUSTOM COMPOUND your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
- WE EXTRUDE any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.

DRYCOL —offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.



GERING *Products*

Are you a large user of Plastic Binding?

Investigate the

New Fully Automatic

Thermatron WELDING MACHINE

. . . Utilizes Thermatron Electronic Equipment

Sealed by the reel!

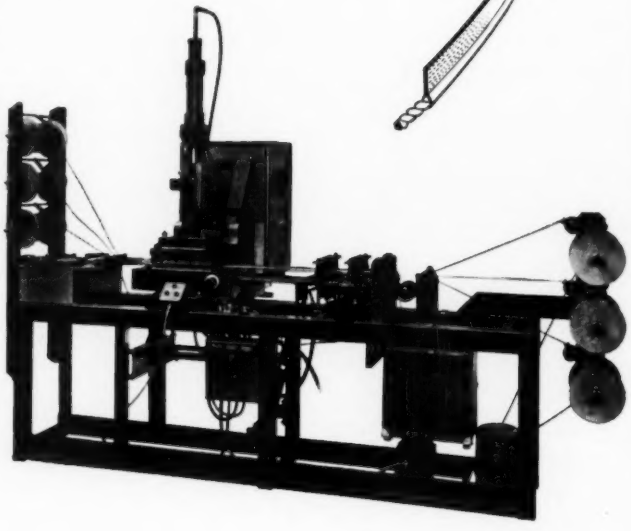
Here's the new plant-tested machine that feeds simultaneously *five* sizes of slit-rolled vinyl with or without cord onto five separate reels . . . Then rewinds the finished binding into tight rolls, ready to use or ship!

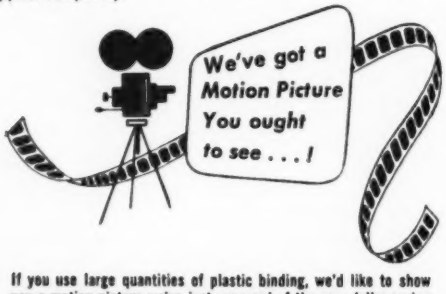
You can make and seal welting or gimp or *both* in any combination on the Thermatron Welting Machine, with production from 5000 to 6000 feet per hour depending upon the design of your binding. And it's practical for long and short runs. Makes binding from self-material in small quantities when necessary, giving you a perfect color match!

. . . Adaptable to make other continuous products for industrial use, such as plastic belting and strapping.

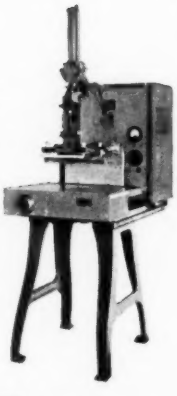
With this flexible new Welting Machine, waste and expensive rejects due to poor sewing are gone forever. Fabrication of the product is no longer complicated by fear of over-sewing stitches on the welting. Operators can now come closer to the bead for finer, cleaner appearance.

And payrolls tumble, too! An operator is needed only for inspection and the easy matter of loading reels. No costly oil and thread bills, either . . . They disappear completely.





If you use large quantities of plastic binding, we'd like to show you a motion picture we've just prepared of the new dollar-saving Welting Machine in action under production conditions . . . Write on your letterhead to Dept. 66.



Standard Thermatron High Frequency Generators and equipment are available from ¼ KW to 6 KW, welding vinyl plastic from .002" to .080", serving most requirements . . . or we can build to special application. Equipment also available for sealing cellulose acetate, for electronic gluing of furniture and other wood products, and for heat treating steel.

Thermatron DIVISION

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

SALES DEPT: 251 West 19th Street, New York 11, N. Y. • FACTORY: 84 North 9th Street, Brooklyn 11, N. Y.

DRY HIGH AND 100%

ATLAC DRY POLYESTER RESINS

DRY... *Dry* polyester resins are easier to handle, easier to use in preform machines. Atlac *dry* polyester resins have longer shelf life, better wettability, better adhesion!

HIGH... Atlac *dry* polyester resins have high wet strength retention, high electrical characteristics, high resistance to acids, high dimensional stability!

100%... These powdered, free-flowing, unsaturated 100% alkyd type polyester resins are ideal for use as solid binders. You can "tailor-make" your formulations for binding, laminating and molding compounds with Atlac resins.

Write today for further information

Industrial Chemicals Department

ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
Offices in Principal Cities
ATLAS POWDER COMPANY, CANADA, LTD.
BRANTFORD, CANADA

Atlac: Reg. U. S. Pat. Off.

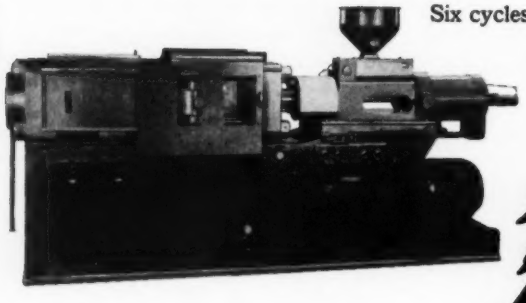
full benefit of the ~~old~~ new ONE-TWO!

Sharp, fast set-up...then the close-in power punch...

that's the essence of Fellows speed-cycle improvement.

The Fellows two-speed injection plunger...rapid advance,

then peak power...is ideal with pin-point gating.



Six cycles per min. (dry-run) on the 5C-8!

Better look at Fellows first.

Fellows
LEOMINSTER

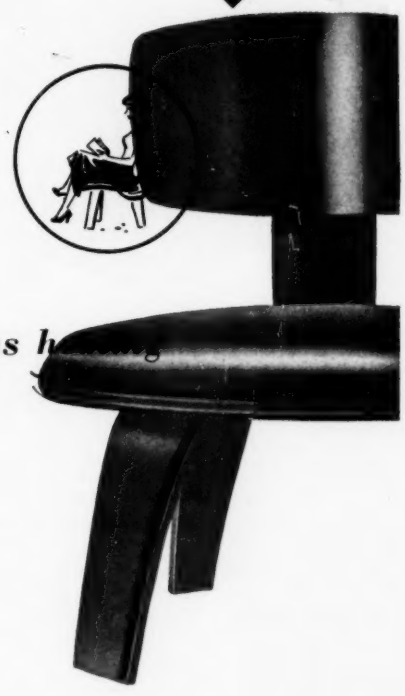
injection molding equipment

THE FELLOWS GEAR SHAPER CO., Plastics Machine Div., Head Office & Export Dept., Springfield, Vt. Branch Offices: 323 Fisher Bldg., Detroit 2. 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1 • New England Distributor: Leominster Tool Co., Leominster, Mass.

FOR FORMING

or

LAMINATING



Dowtherm

means accurate control in process h...

Because DOWTHERM® heating means precision control, constant temperatures and uniform heat application, it makes possible new processes and new products.

In the plastics industry, DOWTHERM, used in molding plastic and rubber products, has improved product quality and reduced operating costs. Many production methods otherwise impossible can be utilized with DOWTHERM heating.

DOWTHERM speeds the heating cycle and at the same time reduces labor costs. Its outstanding characteristic is the accurate control it affords in obtaining temperatures between 300 and 750° F. at low pressures.

Are you fully acquainted with DOWTHERM's higher operating efficiency? We welcome the opportunity to discuss any process heat problems you may be confronted with. Write to Dept. DO 6B.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

SPEEDS HEATING • IMPROVES PRODUCTION

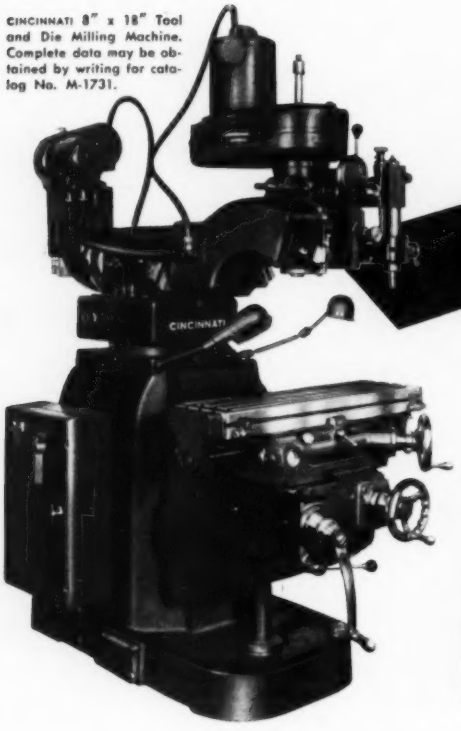
DOWTHERM

DOW

CHEMICALS

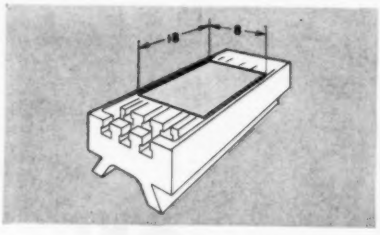
INDISPENSABLE TO INDUSTRY AND AGRICULTURE

CINCINNATI 8" x 18" Tool and Die Milling Machine. Complete data may be obtained by writing for catalog No. M-1731.

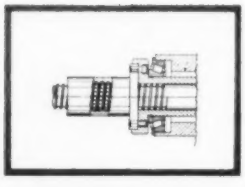


NO RESETTING OF THE WORK within 8"x18" cutting area...

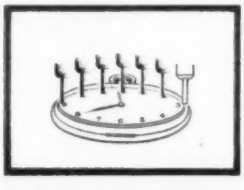
CINCINNATI



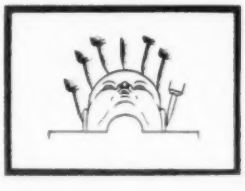
Cutting area in one setting, CINCINNATI 8" x 18" Tool and Die Miller.



Antifriction feed screws . . . do not tire the operator.



Sensitive, accurate depth tracing unit is automatic . . . permits the use of "soft" masters, such as hardwood, plaster, or cement.



Universal cutter head . . . can be swiveled to the angle most advantageous for milling fine details.

A single setting of the work helps a lot to reduce the cost of milling operations on molds and dies. It eliminates the troublesome matching of cuts; saves set-up time; improves accuracy. These are direct benefits offered by CINCINNATI 8" x 18" Tool and Die Milling Machines. Chips can be cut throughout the entire rated capacity of the machine—8" x 18"—in one setting of the work. ¶You'll like this feature when milling the kind of work for which the CINCINNATI 8" x 18" is best suited . . . medium-sized dies, molds and metal patterns. ¶Other features of value are illustrated at the left. Complete data is outlined in catalog No. M-1731. May we send a copy to you?

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES
BROACHING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

MILLS PLASTIC Bottles
shape up to build product sales

CUSTOM BOTTLES—Give free play to your imagination in planning the use of custom shaped ~~CHILO PLASTIC~~ BOTTLES for your products. By combining our engineering and molding skill with our exclusive patented process, we can produce bottles in a surprisingly wide variety of shapes and sizes—and in virtually endless colors. We also make closures and atomizers designed to meet your special needs.

STANDARD BOTTLES—Feather-light Polyethylene standard bottles are available in two styles: Mills "Cylinder" in 2-4-6-8 ounces; Mills "Oblong" in 2-4 ounces. Both of these standard styles are available in natural Polyethylene or in your preferred color. Atomizers, closures and tubing are also available in standard styles and sizes.

Let us or our sales agent show you how we can create product selling bottles for you today.

Manufactured under Patent No. 2,515,093. Other patents pending.

ELMER E. MILLS CORPORATION
2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

Sales agent for the United States: **W. BRAUN & CO., CHICAGO:** 300 N. Canal St. • **NEW YORK:** 715 Fifth Ave. **DETROIT:** 139 W. Maple, Birmingham, Mich. • **ST. PAUL:** 2109 Village Lane

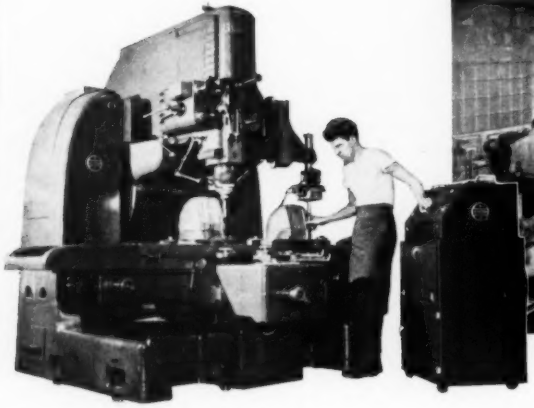
IT'S AN MPc TRADITION...

Never say "Die"

WHEN SPEAKING OF A PLASTIC MOLD

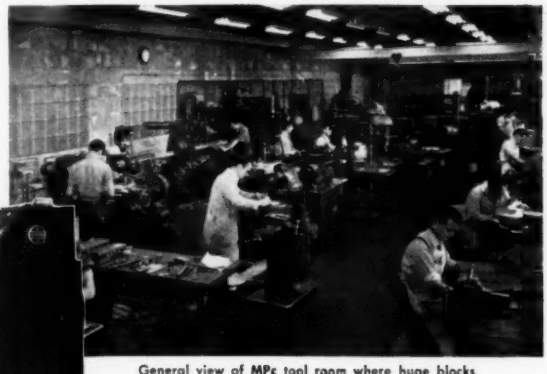
Molds that weigh thousands of pounds are machined to extremely close tolerances.

In pacing the advance to ever-larger plastic castings, **MPc** engineers encountered many a challenging problem in designing, tooling and heat-treating molds of unprecedented size and weight. Successfully processing these huge blocks of steel called for inventive imagination...backed by the facilities of a tool room equipped with the most advanced machines and staffed by highly skilled craftsmen. Today at **MPc,** unmatched facilities and an unparalleled fund of experience are yours to use. Submit your plastics product or problem to MOLDED PRODUCTS CORPORATION, 4535 W. Harrison St., Chicago 24, Ill.



DUPLICATING MACHINE
with "electrical brain"

This 15 C Gorton Electrical Duplicating Machine cuts intricate steel or nonferrous molds by following a wood or plaster model...much faster, more economical and more versatile than ordinary milling. It will take any size cavity up to 32" x 42".



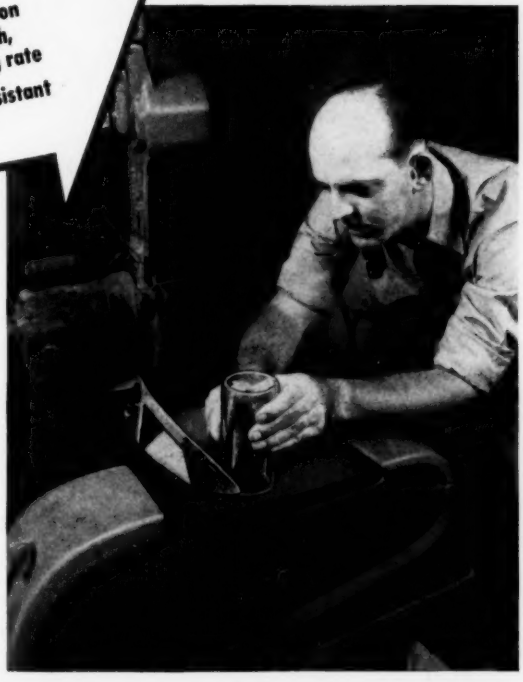
General view of MPc tool room where huge blocks of tool steel are machined to micrometric accuracy.

PLASTICS DIVISION
MOLDED PRODUCTS
CORPORATION

HIGH Quality... LOW COST Finishing

when you use Waterproof Cloth Abrasive Belts by CARBORUNDUM

- Smooth-running splices — no "splice throb" to cause breakage
- Pre-stretched resin-filled cloth backing — high resistance to "wet-stretch" — less down-time for tension adjusting
- Clean, fast, cool cutting action — pre-buff finishes in record time
- Hard, sharp silicon carbide grain — high, continuous cutting rate
- Long, wear-resistant belt life



It's time you got acquainted with Waterproof Cloth Abrasive Belts by CARBORUNDUM. They're specially developed for wet sanding of plastics and other ductile materials subject to plastic flow.

These Belts by CARBORUNDUM hit the bulls-eye in delivering top-quality finishes at rock-bottom cost. Five big features deliver five big advantages to plastic molders by the hundreds, everywhere.

If you're not one of these users, we urge you to put this outstanding product by CARBORUNDUM to the test, on your own work. Call in the CARBORUNDUM man or distributor salesman—today.

WANT ANOTHER cost-cutting idea? Try the Vonnegut Brush-Backed Sander Head, adapted by CARBORUNDUM especially for finishing contours, curves and other irregular plastic surfaces. Cushioned wiping action generates a satin finish, readily buffed out. Effectively blends surface irregularities. Cool, clean cutting produces a finer, more uniform finish with less operator effort. Ask the CARBORUNDUM representative for details, or write Dept. MP 82-52.

Only CARBORUNDUM
TRADE MARK

offers ALL abrasive products ...to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York.

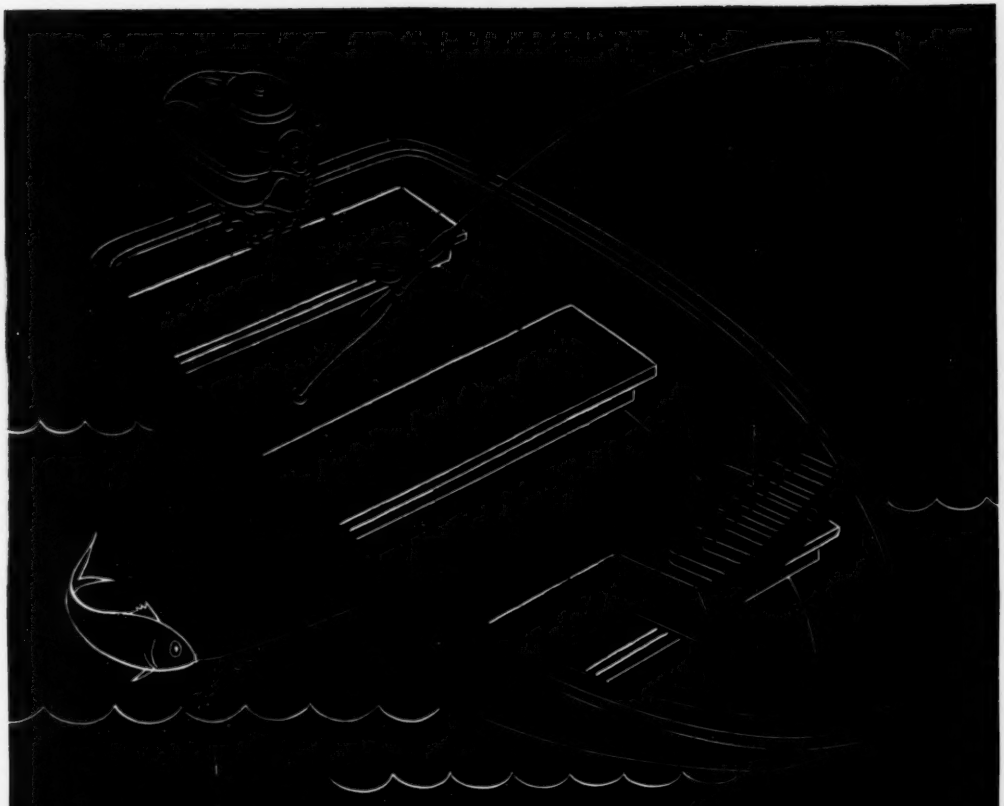
MP-82-52

. . . and when plastics look like metal they sell better . . . sell in larger quantities at higher prices. It will pay you to find out how inexpensively your plastic items can be glamourized.

Metaplast, the pioneer and the largest organization in the industry, has the "know-how" in metalizing on plastics, metal, glass by all methods of coating. For the highest quality production, for reliability in delivery, for economy, you must choose Metaplast.

Metaplast
PROCESS, Inc.
PIONEERS OF MASS-PRODUCED METALIZING

Factory and office: 34-51 56th Street, Woodside, L. I. 77, New York
Phone: HAvemeyer 6-9843



Put yourself in this spot. Get the feel of that power-packed rod. It's light, tough, and it'll never take a set. Look at that outboard motor housing, that tackle box. Bang 'em around, they won't dent, and they'll never corrode or rust. And that boat: she needs no calking or painting, ever!

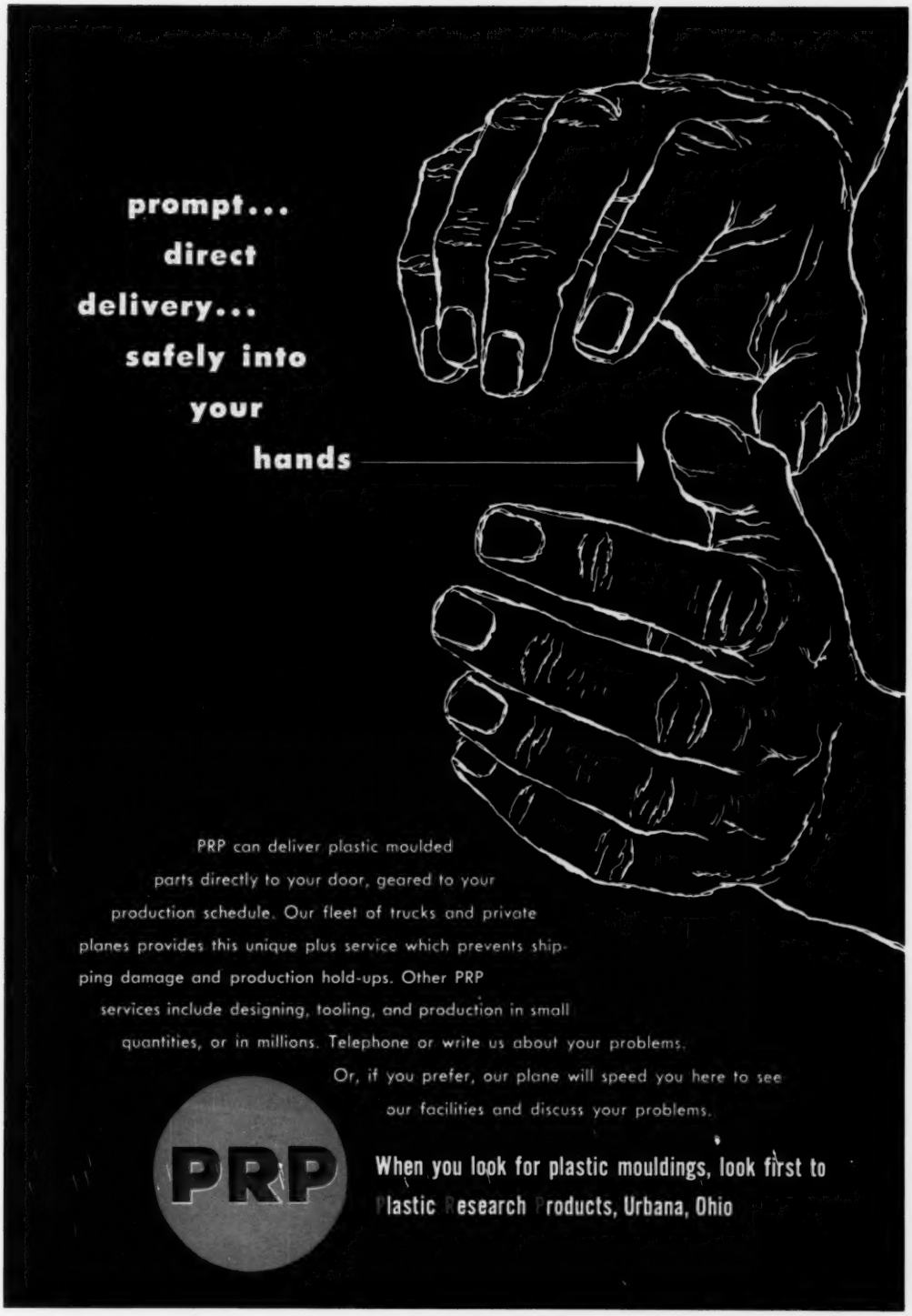
Why? Because all these things are made of Fiberglas — reinforced plastics. Add Fiberglas reinforcements to plastics, and you have a material that's easy and economical to mold, by weight stronger than metal, and resistant to heat, weather, water, and age.

If lack of strength has kept you from taking advantage of the cost-saving characteristics of molded plastics, investigate Fiberglas-reinforced plastics now. For details write Owens-Corning Fiberglas Corporation, Plastics Reinforcement Division, 16 E. 56th St., New York 22, N. Y.

OWENS-CORNING

FIBERGLAS *is in your life..for good!*

Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation


prompt...
direct
delivery...
safely into
your
hands
PRP can deliver plastic moulded parts directly to your door, geared to your production schedule. Our fleet of trucks and private planes provides this unique plus service which prevents shipping damage and production hold-ups. Other PRP services include designing, tooling, and production in small quantities, or in millions. Telephone or write us about your problems.
Or, if you prefer, our plane will speed you here to see our facilities and discuss your problems.
PRP
When you look for plastic mouldings, look first to
Plastic Research Products, Urbana, Ohio

"EYES AND DOLLS"

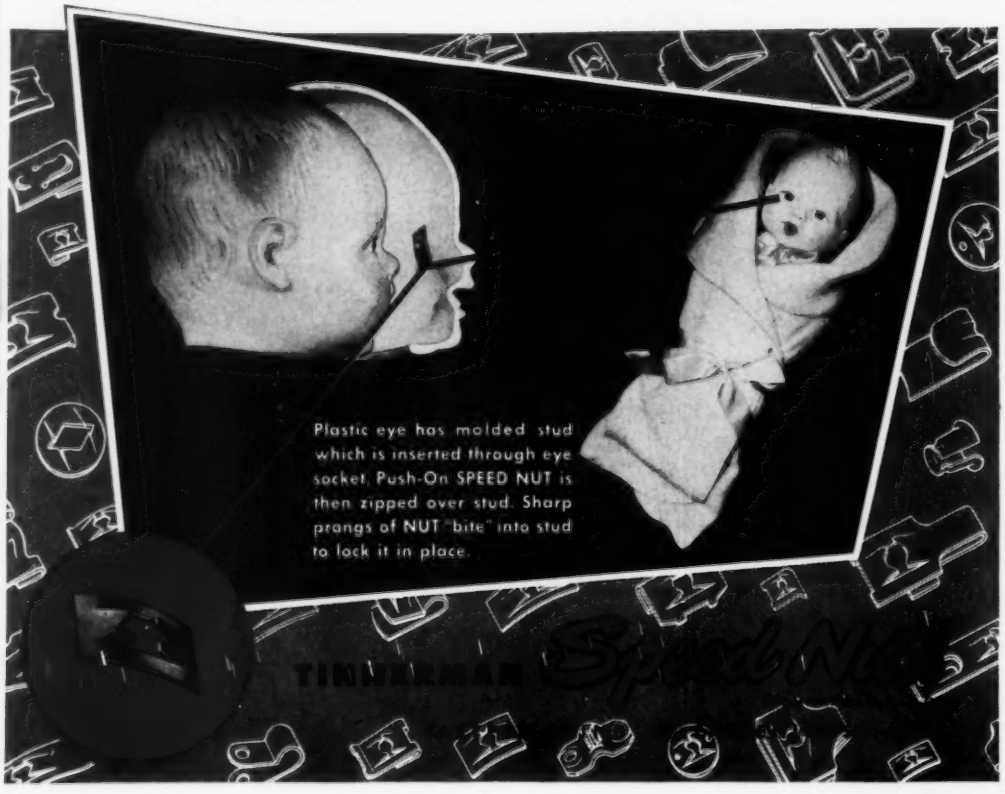
Plastic eyes held in doll's head with Push-On Type SPEED NUTS lead to 40% assembly savings

To please today's pigtail set, Goldberger Doll Mfg. Co., Inc., Brooklyn, N. Y., manufacturers of the EEGEE Doll, has made their newest baby doll unbelievably realistic. Every detail from the soft vinyl "skin" to the life-like plastic eyes does much to create the desired effect.

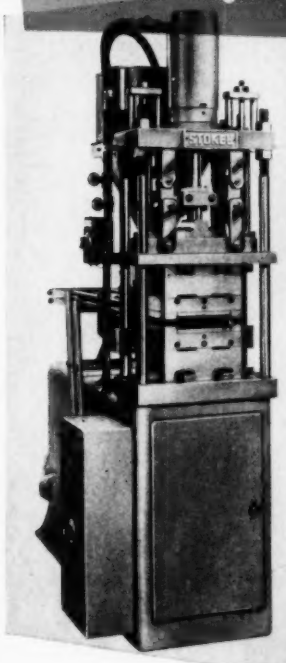
Attaching the eyes to the doll's head was a problem. Goldberger engineers first tried gluing them in place. This proved insecure when the head was compressed. Previous experience with Tinnerman fasteners led them to try Push-On Type SPEEDNUTS. They proved to be the perfect answer.

Furthermore, SPEED NUTS saved many assembly hours and dollars. *Despite an increase in material cost over the glue method,* SPEED NUTS *provided a net savings of 40% in assembly costs!*

If you are interested in further reduction of costs, we suggest that you check with Tinnerman. Call in your SPEED NUT representative soon. Meanwhile, write for your copy of SPEED NUT Savings Stories. TINNERMAN PRODUCTS, INC., Dept. 12, Box 6688, Cleveland 1, Ohio. *In Canada:* Dominion Fasteners, Ltd., Hamilton. *In Great Britain:* Simmonds Aerocessories, Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S. A.—7 rue Henri Barbusse, Levallois (Seine) France.



New Fully Automatic Press molds all Thermosets



Recently introduced to the plastics industry is a new Stokes 15-ton plastics molding press which embodies revolutionary developments in design and operation. Completely adaptable to all types of thermosetting compounds, including alkyds without modification, Model #800 makes a wide variety of simple and complex parts, such as knobs, appliance parts, tube sockets and plugs.

Among the many features offered by the new press are:

EXCEPTIONAL SPEED — A full molding cycle of five seconds, plus cure-time

IDEAL MOLDING ACTION — Fast in closing, slow in pressing

UNLIMITED CAVITIES — Number depends only on mold dimensions, size of piece, press capacity

SHUTTLE-TYPE FEED — All powder measured and placed accurately in each cavity

FULLY POSITIVE EJECTION — Cam actuates the knockout pins, top and bottom

PROTECTIVE DEVICES — Stop the press in event of irregularity in cycle

RAPID MOLD CHANGE-OVER — Molds from earlier 15-ton automatics are fully adaptable to the new press

SEQUENCE-OPERATED — Each step automatically actuated

Model #800 represents the latest achievement in the design and manufacture of plastics molding presses by Stokes, which has been actively engaged in serving the plastics molding industry for the past fifty years.

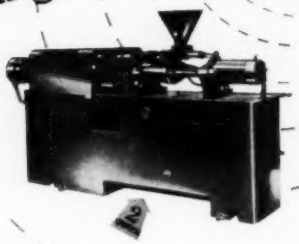
STOKES

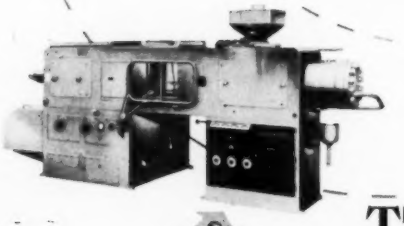
STOKES MAKES
Plastics Molding Presses,
Industrial Tabletting
and Powder Metal Presses,
Pharmaceutical Equipment,
Vacuum Processing Equipment,
High Vacuum Pumps and Gages,
Special Machinery

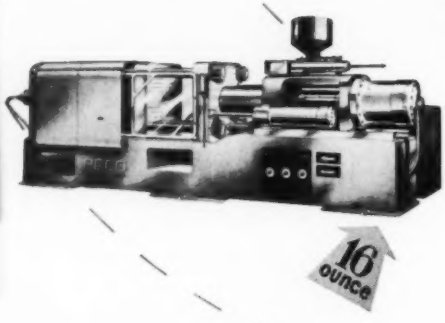
F. J. STOKES MACHINE COMPANY, 5934 TABOR ROAD, PHILADELPHIA 20, PA.

focus on injection moulding machines

PROJECTILE PRODUCTS PECO







THE attention of Plastics manufacturers may profitably be centred on PECO Injection Moulding Machines, for they are designed to give high productivity through maximum efficiency.

They are built in 2oz., 4oz., 8oz., and 16oz. capacities. They represent the most up-to-date development of this type of plant.

Full particulars will be sent on request.

MOULDS

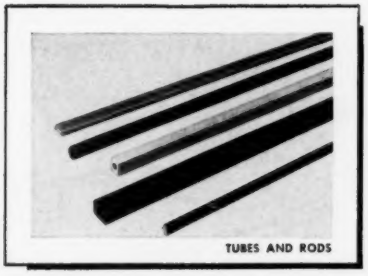
PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if desired. An important side of the Company's work is the hobbing of cavities for moulds and medallions—the plant includes a 3,000-ton Hobbing plant. Master Hobs to customers' samples made as required.

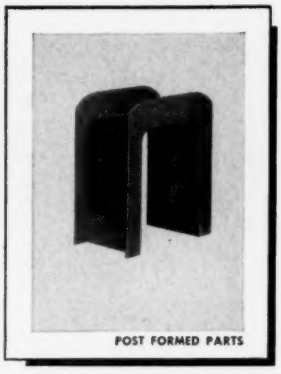
THE PROJECTILE & ENGINEERING COMPANY LTD.

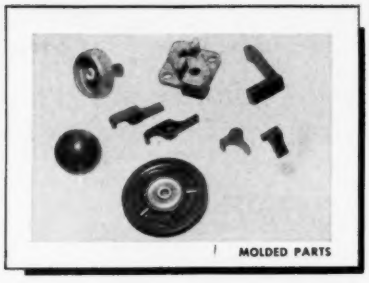
ACRE STREET, BATTERSEA, LONDON, S.W.8, ENGLAND

Telephone: Macaulay 1212 Telegrams: "Profectus, Claproad, London". Cables: "Profectus, London".


SHEETS


TUBES AND RODS


POST FORMED PARTS


MOLDED PARTS


FABRICATED PARTS

here's how you can profit with **Formica**

FORMICA'S FOR YOU

whenever you need a material that's tough, strong, durable • that weighs but half as much as aluminum • that resists corrosion • and that will not support vibration.

FORMICA CAN HELP YOU,

whatever your laminated plastics problem is. The odds are that one of Formica's specialized grades offers the perfect answer. And if there is no "ready-made" solution, Formica's comprehensive engineering resources are prepared to "tailor" a grade to your individual needs.

Why not write today for complete information?

☐ *Send me colorful new booklet showing Formica at Work in Industry*

☐ *Have Formica representative call.*

NAME_____

TITLE_____

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STREET_____

CITY_____ ZONE____ STATE_____

THE FORMICA COMPANY
4531 SPRING GROVE AVE., CINCINNATI 32, OHIO
laminated plastics headquarters since 1913

Productive FORMICA at Work in Industry

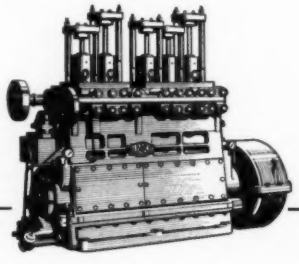
SPEED ADVANCEMENT

Aldrich did it with Direct Flow Pumps

Not too long ago, 150 rpm was considered high speed operation for reciprocating pumps. But today—as a result of improved design and stronger metals—Aldrich Direct Flow Pumps are operating efficiently at *or over* speeds of 500 rpm for the 3″, 360 rpm for the 5″, and 300 rpm for the 6″ stroke unit. This increase in speed means simply this:

You get more work—greater pressure and volume—out of a smaller pump. You invest in a lighter, lower cost unit . . . a pump with a *sectionalized* fluid-end that's extremely easy to maintain and which can be made of stainless steel, bronze, Monel or other special material, as desired.

To meet your molding, extrusion, and other needs involving hydraulic pressure, Aldrich can design and furnish your *complete* hydraulic system—incorporating Aldrich Pumps, by-pass valves, controls, accumulators, and control systems. Write for full details.



THE ALDRICH PUMP COMPANY

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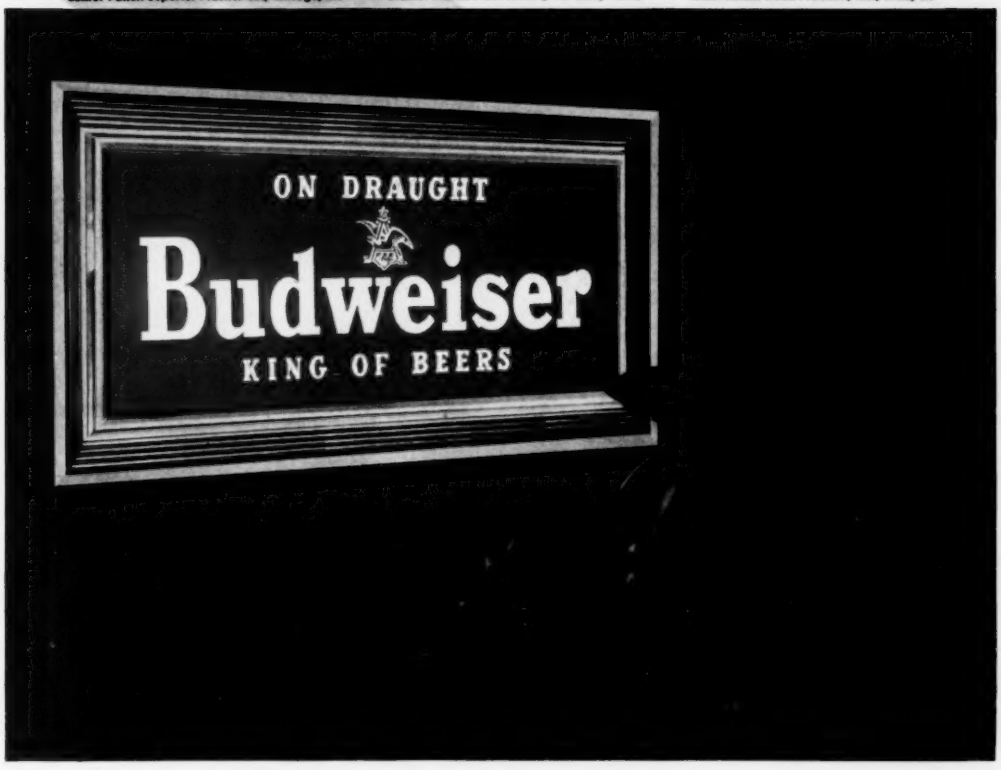
...Originators of the Direct Flow Pump

Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa • Export Dept.: 751 Drexel Building, Phila. 6, Pa.

Center Panel: Superior Plastics Co., Chicago, Ill. Frame: Fralon Plastics Div., Florence, Mass. Construction: Neon Products, Inc., Lima, O.



...and Koppers Polystyrene is "on draft" for eye-catching displays

● The extruder of the center panel of the attractive Budweiser® window or bar display shown above experimented with several competitive plastics before he chose Koppers Polystyrene for the job. With competitive plastics, he was unable to achieve the smooth finish and sturdy strength he desired. Koppers Polystyrene not only gave him those essential characteristics, but also permitted the extrusion of the center panel at temperatures which allowed a speed-up in the rate of production thereby reducing the unit cost of the operation. And the smooth surface of the panel took silk screen printing extremely well.

About Koppers Polystyrene, the extruder wrote: *"It has increased our production substantially over other competitive materials."*

Koppers Polystyrene also solved the problem of the frame for the panel. The frame is injection molded, and offers good looks and firm protection to the panel and electrical circuit.

Koppers has the information and technical assistance that can help you solve a molding problem. Among the formulas of Koppers Polystyrene there is a type to fit your particular needs. Koppers technicians are anxious to work with you in developing new applications for Koppers Polystyrene and in obtaining the best results from your use of this versatile plastic.

Koppers Plastics make Many Products Better and Many Better Products Possible.

KOPPERS

KOPPERS COMPANY, INC., Chemical Division, PITTSBURGH 19, PA.

SALES OFFICES: NEW YORK • BOSTON • PHILADELPHIA • CHICAGO • DETROIT • LOS ANGELES

"What clue to quality can they offer you?"

PERFECTLY MATED! Only Phillips Drivers are perfectly mated to Phillips Screws. Look for the name Phillips on the shank.

AMERICAN SCREW COMPANY • ATLANTIC SCREW WORKS, INC.
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CONTINENTAL SCREW CO. • THE EAGLE LOCK CO. • ELCO TOOL AND SCREW CORP.
GREAT LAKES SCREW CORP. • THE H. M. HARPER CO. • THE LAMSON & SESSIONS CO.
NATIONAL LOCK CO. • THE NATIONAL SCREW & MFG. CO. • PARKER-KALON CORP.
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ANSWER: Phillips Cross-Recessed-Head Screws—a clue that more than 15 million readers of The SATURDAY EVENING POST are being told to look for. When you assemble your product with these famous fasteners, you give it an *extra* mark of quality that registers on sight! Remember, too, you save time, work, and money when you use Phillips Wood, Machine, Tapping Screws or "Sems". They start faster, do away with driver skids, damaged parts, split screw heads. They set up tighter, resist vibration . . . and add structural strength. Include Phillips Screws in your specifications.

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The Latest Edition of THE CARVER LABORATORY PRESS

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● **Plastic Molding of Thermosetting and Thermoplastic Materials**—Molding samples, production and color control work, testing single cavity molds, etc.

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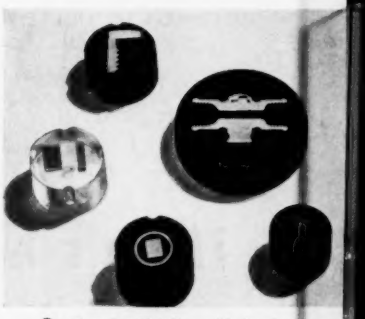
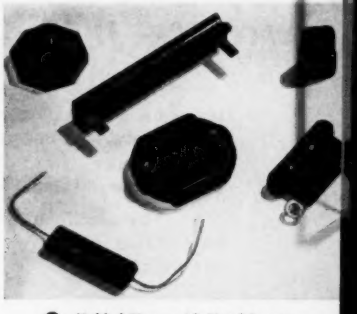
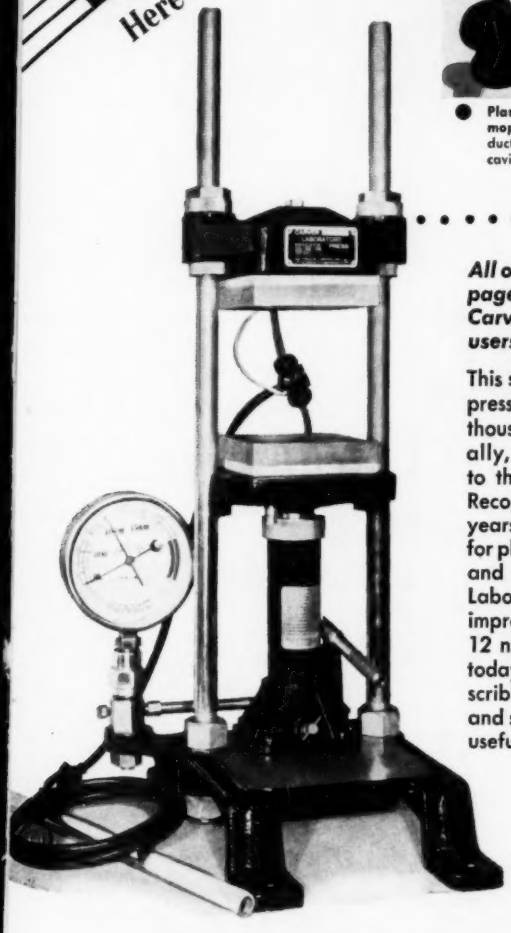


● **Mounting Metallographic Specimens**



● **Molded Pieces with Metal Inserts**



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Uniform gage maintained with calender rolls on TIMKEN® bearings

Roll neck wear is eliminated

WITH calender rolls mounted on Timken® tapered roller bearings, the gage of plastic film and rubber sheeting is maintained longer than is possible with sleeve type bearings. Rolls stay in accurate alignment maintaining uniform gage the length and breadth of the sheet.

Since there is no friction between roll neck and bearing, roll neck wear is eliminated. Calenders maintain precision with fewer overhauls. And downtime is minimized since roll necks don't require machining.

The true rolling motion of Timken bearings, plus the smooth surface finish of rollers and races, virtually eliminate friction. Wear within the bearing is negligible, calender roll precision is maintained for longer periods of time.

With Timken bearings, calenders can hold gage to minimum tolerances. Yield is increased — you get more yards per pound. Tapered construction of Timken bearings permits them to take radial and thrust loads in any combination. And due to line contact between rollers and races, Timken bearings have load carrying capacity to spare.

Get the advantages of Timken bearings in your calenders, mills, refiners and mixers. For full information, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

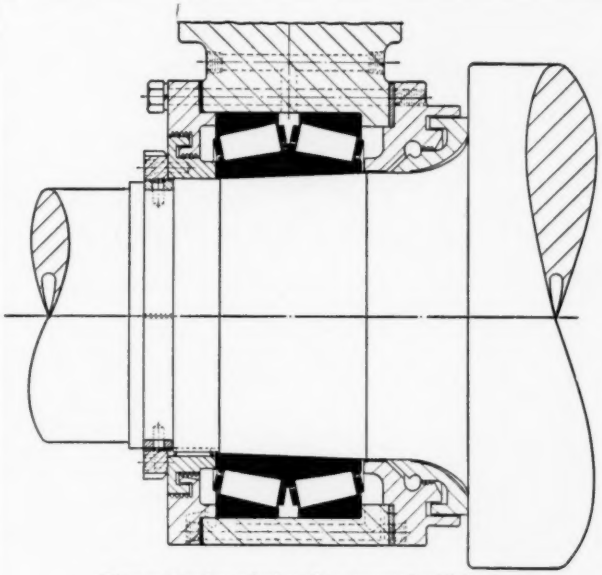


Diagram shows how calender rolls are mounted on Timken bearings to maintain accurate gage of plastic film and rubber sheeting.

TIMKEN

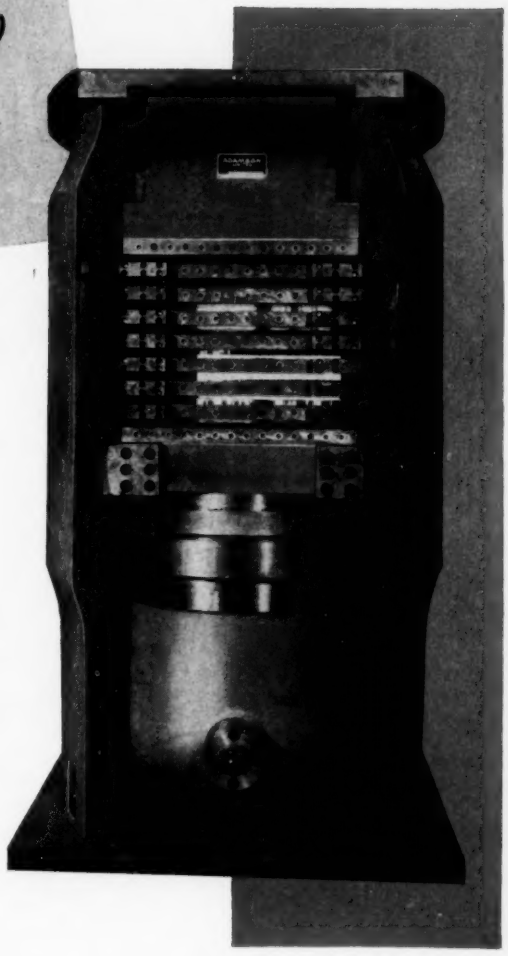
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION

INCREASE PLATEN PRESSURE
45% to 76%

With no change in your present hydraulic lines

...With the NEW ADAMSON UNITED BARREL PRESS



The new Adamson circular-side-plate, or Barrel Press is designed for high pressure molding of synthetic rubber and rubber plastic products. It provides pressures as high as 1800 pounds per sq. in., or approximately that required for light metal forming, with no change in the hydraulic lines that are now operating conventional, low pressure, rod-type presses.

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We believe you will be interested in the economies the Adamson Barrel Press can effect in your operation from the standpoint of both scrap reduction and accelerated product output. Your request for further information will not obligate you. Why not write today?

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Subsidiary of United Engineering and Foundry Company

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Rx Vinyl Dispersions

plastic coating and molding compounds

The Plastics Industry is rapidly discovering that vinyl dispersion compounds lend themselves to the development of many new products. They are versatile and can be used both as coatings and molding compounds.

The wide range of applications are illustrated by the diversity of uses such as coatings on wire and wire formed objects, cloth coatings, glove coatings, and coatings for metal furniture; to molded objects, such as dolls and doll parts, atomizer bulbs, mannequin parts, electrical parts and many others.

The Watson-Standard Company offers five different types of vinyl dispersions for a wide variety of applications:

PLASTISOLS: Vinyl Resins dispersed in plasticizers—considered 100% solids—no volatile material—used both as coating and molding compound—for example, doll and doll parts, or textile coatings.

FOAMOSOLS: Plastisol type incorporating a blowing agent—requires no external pressure for foaming—for use as shock absorption parts, or textile coatings.

RIGIDSOLS: Special type of plastisol, of low viscosity but with high degree of rigidity, excellent for molding objects where toughness and resiliency are desired and still retain their rigidity.

PLASTIGELS: Gelled vinyl plastisols—Plastigels may be extruded, calendared, molded, spread or embossed, all of which have excellent retention of detail out of mold and retain their shape during fusion.

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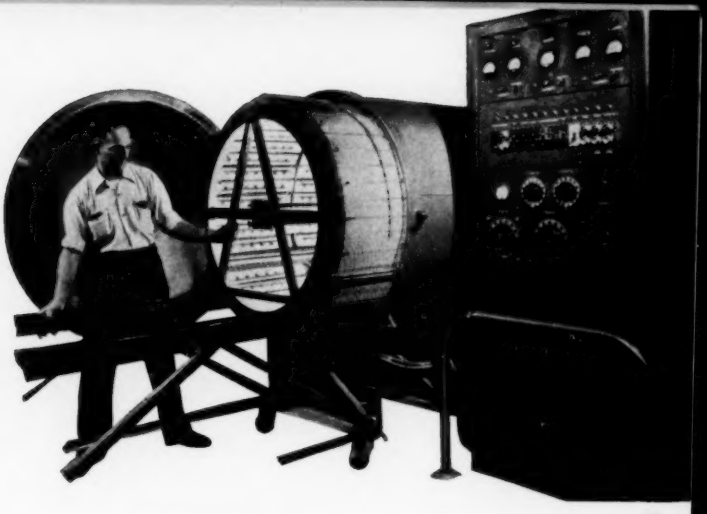
Big fellow...



or little fellow

There's a DPi **high vacuum** metallizing unit to fit your requirements exactly

Whether you want to turn out a small quantity of rich-looking nameplates from fine, clear plastic, or thousands of fast-selling toys from scrap, DPi can supply you with the high vacuum metal coating equipment you need.

The little fellow is DPi's Model LC 1-12A with a 12-in. diameter coating chamber. The big fellow is DPi's Model LC 1-48A with a horizontal chamber 4 feet across and 5 feet long. Besides these, there are six other regular models. As with all DPi vacuum coating units, they come to you with controls, electrical circuits and measuring instruments you need for fast, easy operation.

With vacuum metallization, you can coat most plastics with a submicroscopically thin film of almost any metal—aluminum, copper, gold, nickel, silver, or what have you. It takes less than an ounce of metal to coat hundreds of pieces—lets you forget about metal-shortage problems. The bright finish needs no polishing or buffing—is usually made tough and durable by a topcoat of lacquer.

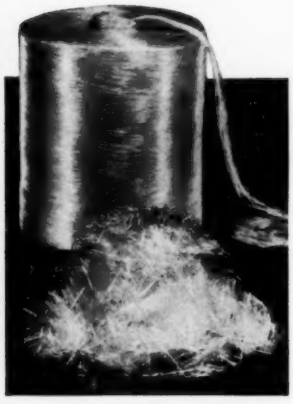
DPi is ready to help you get started in this rapidly growing business with the most efficient vacuum metallization equipment available. A new booklet giving detailed information on DPi vacuum coating units is yours for the asking. Just write to ***Distillation Products Industries,*** Vacuum Equipment Department, 779 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company).

high vacuum research and engineering

DPi

Also . . . vitamins A and E . . . distilled monoglycerides . . . more than 3500 Eastman Organic Chemicals for science and industry

Washing-machine tub, reinforced with fibrous glass, is typical of the applications which are possible and practical. L·O·F Fiber·Glass gives reinforced plastics strength comparable to that of steel.



Roving, chopped strand and textile yarns of L·O·F Fiber·Glass. Glass fibers have tremendous tensile strength (250,000 lbs. per sq. in.). Won't deteriorate under normal conditions.

Libbey·Owens·Ford is ready to work with you in developing new uses for reinforced plastics

L·O·F Fiber·Glass of fine quality now available — backed by Libbey·Owens·Ford glass technology

Many new and interesting reinforced-plastics applications are real possibilities with L·O·F Fiber·Glass. Libbey·Owens·Ford wants to work with you in developing them.

Together we should form an ideal working combination. You have skilled personnel thoroughly schooled in molding techniques. L·O·F has long experience in glass technology. In addition, the Plaskon Division of L·O·F knows plastics and their uses, through broad research.

Let's sit down and talk about the possibilities of L·O·F Fiber·Glass in your field. Or if you are now using fibrous glass for plastics reinforcement, why not look to L·O·F as a new source ready to provide products of the highest quality.

For technical data or consultation, contact your local L·O·F office (branches in 24 major cities). Or write, wire or phone Libbey·Owens·Ford, Dept. F·G 1542, Nicholas Building, Toledo 3, Ohio.

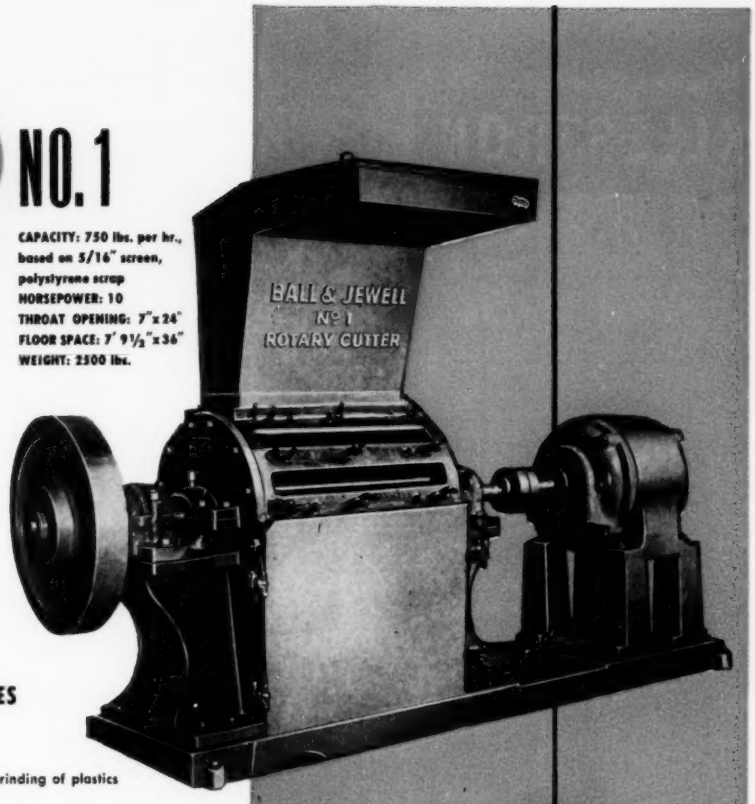
L·O·F FIBER·GLASS

LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

FIBER·GLASS

b&j NO. 1

CAPACITY: 750 lbs. per hr., based on 5/16" screen, polystyrene scrap
HORSEPOWER: 10
THROAT OPENING: 7"x24"
FLOOR SPACE: 7' 9½"x36"
WEIGHT: 2500 lbs.



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- For high production grinding of plastics molding scrap
- Low Cost — Medium Duty
- Re-Designed and improved again in 1951 (first model built in 1895).

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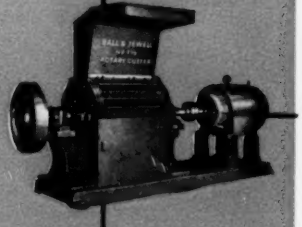
Ball & Jewell No. ½ T. D.
Throat openings of 5½"x20" or 8"x20". Horsepower, 7½. Capacity, 500 lbs. per hr.



Require A Larger Machine?
Ball & Jewell No. 1½
Capacity rating, 1200 lbs. an hr. with 30 horsepower motor. Throat opening of 26"x8".

Your grinder source for every individual plastic material cutting requirement and capacity (50 to 3,000 lbs. per hr.)—Ball & Jewell, machine tool builders since 1865, have always paced the grinding needs of the plastics industry. Send us your requirement specifications.

BALL & JEWELL, INC. *Leadership Through Continuous Engineering Improvements*

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CRUCIBLE MOLD STEEL is TOOL STEEL

You profit because mold steels are tool steels at Crucible. Our reputation as specialty steel leaders was built with tool steels.

That means you get all the experience of more than half a century of tool steel leadership when you buy mold steel from Crucible.

Crucible mold steel *is* better—because it's tool steel. And you'll find mold steel stock in strategically located warehouses from coast-to-coast.

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PLASTICS FOR INDUSTRY

CRUVER is proud to again have a part in Philco's 1952 Refrigerator program.

Illustrated above are handle inserts, decorated by CRUVER's "Bas-Releef" process. In addition to our decorative facilities for nameplates, escutcheons, etc., we have press capacity up to 60-ounces for large plastic components such as evaporator doors, trays, breaker strips, etc. These large pieces can also be decorated in standard lacquers and bright finish. Let CRUVER do the entire job for you—castings, painting, and assembly.

CRUVER Manufacturing Company

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PIONEERS IN PLASTICS SINCE 1896

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Branch Offices: DAYTON • DETROIT • MINNEAPOLIS • NEW YORK • PHILADELPHIA • SYRACUSE

From Giant Radomes That Protect Electronic Equipment—To Helmets For Construction Workers!

Pittsburgh Selectron Polyester Reinforcing Resins

Now Ready For a Thousand New Uses

PITTSBURGH SELECTRON Resins have opened numerous opportunities for vastly broadened product usefulness with greatly reduced manufacturing costs in many cases.

● **When combined** with suitable fillers—Fiberglass, cotton, rayon, nylon, felt, sisal, paper, etc.,—SELECTRON Resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

● **Because of such unique** and distinctive advantages, SELECTRON Resins are today being used in a wide range of products. These are as different in size and shape as helmets for construction workers, manufactured by the Automatic Plastic Molding Company, of Berkeley, Calif., for the E. D. Bullard Company, of San Francisco, and giant radomes that protect electronic equipment in aircraft, produced by several large makers.

● **SELECTRON Resins** are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fillers for casting, potting and impregnating.

● **Because of their** unusual utility, more and more manufacturers are probing the seemingly endless possibilities of SELECTRON Resins. If you are designing a new product, or redesigning one you are now making, SELECTRON may help you make it lighter, stronger, more durable and, possibly, at lower cost. Call on us for *free* advisory service. We may be able to save you time and money.

Send For FREE Booklet!

● Write, wire or phone today for our new booklet containing description of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, 2000 Grant Building, Pittsburgh 19, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
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Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Helmets
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

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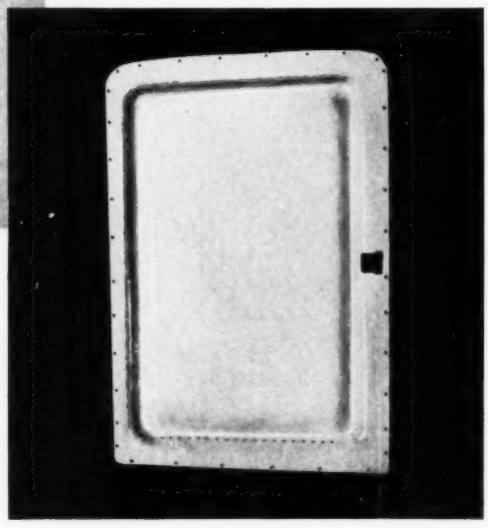
PITTSBURGH PLATE GLASS COMPANY

The Nose of a Proximity Fuse

A major producer during World War II of plastic parts for the VT (Proximity) Fuse, parts to withstand forces 20,000 times that of gravity but still small, light weight and inexpensive.



The Door of a Refrigerator

A supplier of refrigerator door liners to one of the country's leading manufacturers. They combine strength, light weight, resistance to cracking, chipping and discoloration, and a smooth, glossy surface.

Both are Products of Prolon Plastics!

THESE ARE only two examples of the range and quality of Prolon Plastic products. The complete services of the company are available to you, services including research, design, engineering, die-making, molding and assembling.

Whether you're interested in tiny proximity fuses, enormous refrigerator doors or any of the countless quality products Prolon can make for you, write for free informative booklet illustrating Prolon's facilities and services. Address:

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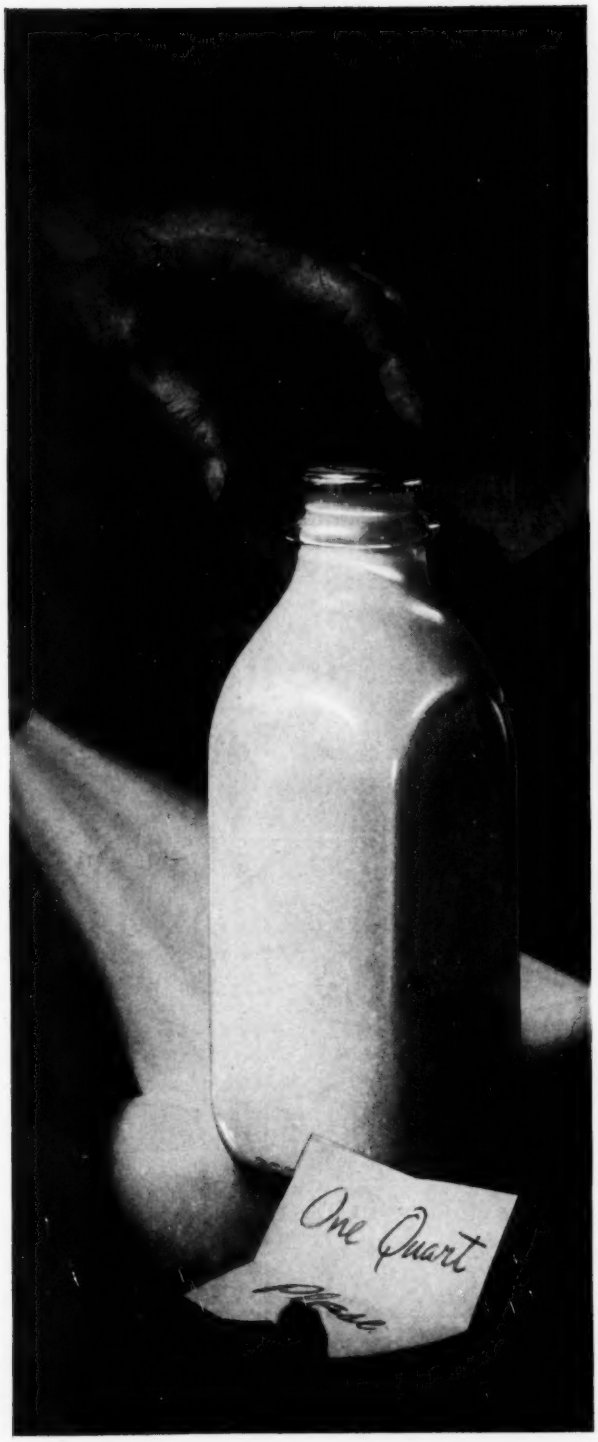
Florence, Massachusetts; Toronto, Canada



5 a.m.

A bottle of milk is the last scene in the last act of the cow-to-cup drama.

The real stars in this drama are milking machines, pasteurizers, bottle washers, homogenizers, and delivery trucks. Synthane—a laminated plastic—plays an unseen but essential part in these and other kinds of electrical and mechanical dairy equipment.

The dairy industry appreciates, as you may, the fact that Synthane is strong, light in weight, chemical-resistant, easily machined, and a good electrical insulator—all rolled into one. And that it is available in sheets, rods, tubes, and fabricated parts.

Try Synthane laminated plastics yourself. There is an interesting 26-page catalog of its properties and possibilities waiting for you. Synthane Corporation, 8 River Road, Oaks, Pennsylvania.

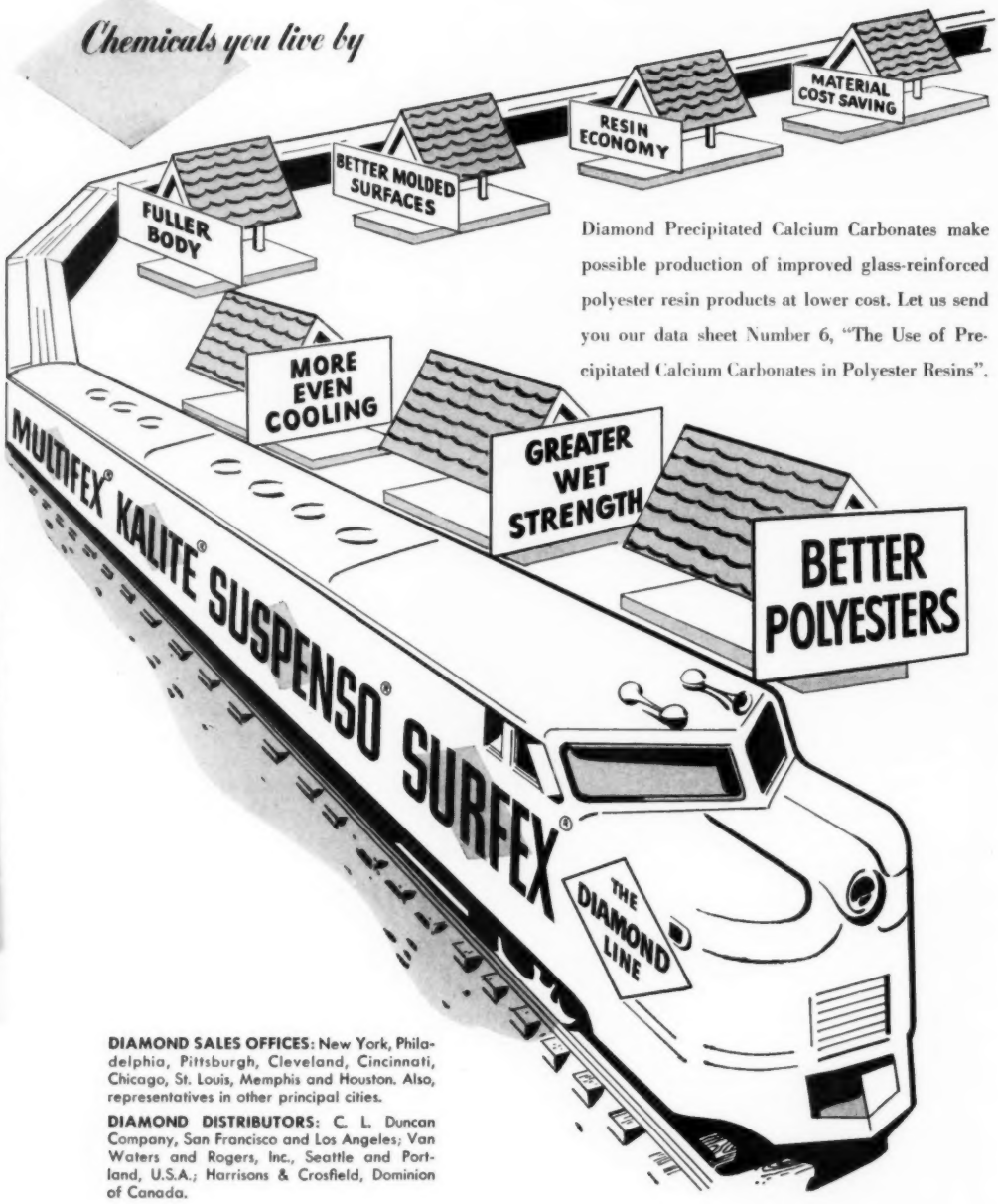
AIRCRAFT electronics system part, made from Grade LE Synthane. Application requires good electrical properties, resistance to moisture, retention of size and shape at elevated temperatures.

Synthane-one of industry's unseen essentials

SYNTHANE

LAMINATED PLASTICS

Chemicals you live by



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DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also, representatives in other principal cities.

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MULTIFEX® • KALITE® • SUSPENSO® • SURFEX®

Ride the DIAMOND Line to Better Polyester Products

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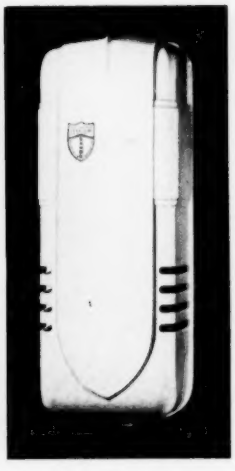
DIAMOND ALKALI CHEMICALS

OLD CUSTOMERS have reason to choose NORTON

Rochester Germicide Co., Rochester, N. Y. has been buying custom molding from Norton since 1938



ONCE INSTALLED, commercial washroom equipment is expected to last for a long time, not to require early replacement or refinishing.

After their experience, beginning 1938, with a Norton molded urea housing for their "Sanor" disinfectant container (shown at right), the Rochester Germicide Company, naturally turned to Norton when they decided to convert another of their units from enameled metal to plastic.

The "Aro" soap dispenser, now a familiar item from coast to coast, was first injection molded by Norton in 1950. Its one-piece, integrally-white construction results in a considerable reduction in manufacturing costs and a more serviceable product than was available previously.

During the development and production of these pieces, the people at Rochester Germicide Company have discovered the value of Norton's sound engineering counsel, sensible pricing, flawless molding and all-around cooperative service. It is for these reasons that customers, old and new, prefer Norton.

Norton is interested in having you discover their value, too. For an example of what we mean, ask for a free survey of your next molding assignment by a Norton Engineer from our nearest sales office. Write today. Norton Laboratories, Inc., Lockport, New York. Sales offices: *New York — 175 Fifth Avenue; Chicago — 5221 Kimbark Avenue.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

Consult a specialist . . .

when you want

HOBS, HOBBED CAVITIES and Plastic Molds

And that describes us perfectly because we have been specializing in the production of HOBS, HOBBED CAVITIES and PLASTIC MOLDS for many years. Countless numbers of the country's leading molders today are using HOBBED CAVITIES and PLASTIC MOLDS by Metalmasters.

We would like to acquaint *you too* with our exceptional facilities for serving *your* needs, and invite your inquiries when in need of HOBS, HOBBED CAVITIES and PLASTIC MOLDS.

We also make ZINC DIECASTINGS

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IDEAS

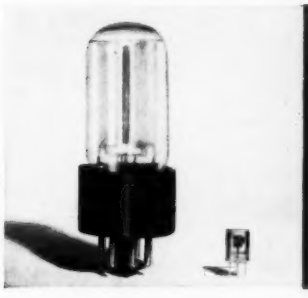
in the news

ARALDITE Bonding, Casting, Coating Resins and ARDUX* Bonding Resins developed by Ciba Research are simplifying manufacturing methods, improving product efficiency, and opening new fields of product development. Some important new and typical "in use" examples are shown and described here.*

"ELECTRONIC REVOLUTION"!

says the Nation's Press

ARALDITE RESINS specified as important component of this newest advance in "Electronic miniaturization."



ARALDITE CASTING RESINS have remarkable fluidity and exceptional penetration which along with their high dielectric strength, arc, corrosion and humidity resistance, affinity for metals, etc. have established their selection for filling and embedding a wide range of electrical apparatus, large and small.

ARALDITE BONDING AND COATING RESINS are similarly outstanding for their respective properties. All Araldite Resins harden practically without evolution of water or volatile matter, are economical and easy-to-use.

SEND THIS COUPON . . . or write us on your Company letterhead . . . for latest technical bulletins on physical properties and recommended procedures for use of Araldite Bonding, Casting and Coating Resins.

*Reg. U.S. Pat. Off.

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*Name*_____

Company _____ *Title*_____

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A SPECIAL SERVICE TO MODERN PLASTICS READERS, REPORTING AND INTERPRETING THE LATEST NEWS AND DEVELOPMENTS FROM WASHINGTON AND ELSEWHERE AS THEY AFFECT THE PLASTICS INDUSTRY AND THE MOBILIZATION PROGRAM

Modern Plastics BULLETIN

March 18, 1952

Plastics Applications in 1952

March sales of plastics materials have been watched with more keen interest by sales managers than for any month in recent history: this is the month that sales were scheduled to begin an upward move. Every optimistic note that it is possible to draw out of current happenings is seized upon as an augury of better sales ahead.

As a neutral observer, we can't find many facts to prove that there has as yet been much improvement in plastics materials sales since December.

Order for Refrigerator Parts

Best example of good news in the thermoplastic molding industry is the report of a polystyrene molder who used up all his big inventory on a refrigerator part and ordered substantial new quantities for a refrigerator manufacturer who claims he is on the way back to large volume production. That is good news indeed. Refrigerator sales dropped from 5,848,579 units in 1950 to 3,797,260 units in 1951—in December 1951 sales were 211,442 compared to 394,269 in December 1950.

Other appliances using plastics parts showed similar declines. Washer sales for example were 33.4% greater in January 1951 than in January 1952. Production of appliances in 1952 was scheduled for severe cuts due to metal shortages, but that condition has been somewhat alleviated by allocation of more metal. Relaxation of building curbs which may result in a million instead of a recently forecast 700 thousand homes units as well as government permits to build commercial structures in 1952, should also provide more markets for electrical fixtures and wiring devices, coated wire, hardware, tile, and furnishings. The automotive industry is also planning to make several hundred thousand more cars in the second quarter than originally planned and will therefore require several million pounds more plastics than anticipated earlier.

When consumers are ready to buy the above named items, plastics will regain a good portion of the volume that has been declining since last fall, but not all of it. In order to reach 1950 and early 1951 sales levels, molders in particular will have to bring out new molds and go after new business.

That Melancholy Inventory Baby

Inventory has been a naughty word in the plastics industry for many months. About a year ago, the government officially implied that it was sinful for any man to have more than a working (generally about one month's supply) inventory of any scarce material. Nearly all plastics were scarce at that time. A few extra drums of molding powder in reserve were as luscious to look upon as that big red-head in the Sultan's harem.

Along about September or October—even earlier in the case of some materials—most plastics users had become sinners—they had started to build inventories. But the Government stopped worrying about such sinners because by then there was plenty of material. In early 1951 most plant managers considered a big resin inventory as good as or better than money in the bank. When business showed signs of a slump in early summer, they still bought for inventory on a gamble that military purchasing and the usual fall upswing would result in a greater materials shortage than ever, starting about September. But the failure of military demand to materialize, plus a slump in the market, plus more availability of raw materials, brought on an inventory glut that apparently has not yet been entirely removed. It extends from the producer of raw materials all the way back to such things as phenol and clear down the line to the retailers' shelves—even into mother's closet, no doubt. Possessing excess inventory is still a sin—but, "brother, she ain't beautiful to look upon no more—now she looks more like a hag."

Pertinent to the subject is one molder's remark: "The tightest thing in plastics today is warehouse space."

The most plausible explanation of this situation

is that the cut-back in refrigerators, automobiles, television sets, and other appliances, plus the slump in consumer purchasing of house furnishings and toys after the scare-buying period, was never completely taken up in other items. Molders, for example, were so busy filling orders on hand that they didn't have time to go after new business and feared they couldn't get material anyhow. For one reason or another, they didn't realize that cut-backs and a declining consumer market were braking the boom. Even though orders were not in sight, they ordered resin in anticipation of the usual big fall season which never came. Some of them have been operating at a fairly good rate without buying any resin for weeks because of the huge quantities they stored away in the fall of 1951. It just doesn't seem possible that this condition can exist much longer. Those big inventories can't last much longer and we have heard of no processors who have completely shut down.

Heaviest Decline Started in December

Recently published U.S. Tariff Commission's sales figures for December add emphasis to these inventory blues. Nearly all plastics dropped more than had been generally estimated. Phenolic molding powder was perhaps the greatest surprise; it declined to 12½ million from 16 million lb. in November. All year long the total had been fluctuating between 15 and 20 million lb. a month. It wasn't believed that sales would drop much below 15 million lb. because phenolic demand has been relatively constant and not thought to be inflated to any considerable degree. Largest volume producers are unable to account for this sharp decline; they report that their sales show no such negative ratio.

Thermoplastics Inventories

Polystyrene molding powder sales dropped from 23.3 milion in October to 19.4 million in November and to 14.3 million lb. in December. This decline in sales was not unexpected since it was known that inventories were reaching maximum proportions.

Cellulosics (including Valite and ethyl cellulose) had been running from 5 million to 7 million lb. a month all year until November. In December they dropped to 3 million. If it were not for the growing butyrate pipe business the drop would have been still greater. Film reversed a seasonal trend; it declined from an average of over 2 million a month to 1.3 million lb. in December, but a strike in the plant of a major producer was a contributing factor in the drop.

From what we have been able to learn in the trade, none of the above materials have made appreciable sales gains since December. Furthermore, exports started to decline rapidly about mid-1951, and are likely to stay down until there is some alleviation in the international dollar exchange situation.

The vinyls (all types, including butyral, saran, and acetate, as well as chloride) give a good picture of the inventory situation. Sales of the entire vinyl industry in 1951 were around 390 million lb., of which about 330 million lb. are estimated to be vinyl chloride and copolymers. Production figures (all vinyls) were over 460 million lb., thus leaving a two month's inventory supply in the hands of producers in addition to that held by processors. Total vinyl sales fell under 30 million lb. in December for the only month in 1951. From March through August monthly sales of resin had been running from 34 to 37.2 million lb., despite the decline in film sales which became noticeable in late spring. But production of resin has been at a rate of nearly 40 million lb. a month or more ever since last April.

For the first time in several years, molding and extrusion vinyl chloride resin sales in 1951 exceeded resin sold for film. The biggest portion of this material goes for wire coating and phonograph records. Sales in this classification are still at a high level. But the over-all sales of vinyl chloride haven't shown too much improvement since December. It's a confusing picture because vinyl is used for so many purposes and the decline in sales for each purpose is by no means uniform.

Film and Sheet in Reverse Trends

In the combined sheet and film field, resin sales for film have shown only limited improvement. It is claimed that producers of film who maintained their price and quality standards in mid-year, when the battle for markets was severe, are now reaping their reward. These producers are in a position to adjust prices to fabricators and, because of the known quality of their goods, have moved into markets formerly supplied by lower quality film producers. The latter are in no position to reduce prices and still stay in business, and the fabricator naturally turns to the supplier of high quality film when there is no price differential in his favor.

Vinyl sheeting has not suffered a sales loss anywhere near comparable to film. The upholstery and luggage covering market has been broadening out at a great rate, and sheet for floor coverings, inflatables, and rigid applications is claimed to be steadily advancing.

Polyester Notes

"This is the year!" So say the polyester-glass enthusiasts. It's not a new war cry. It has been heard before. But this *could* be the year when several Armed Forces applications should come definitely into being. Once they are on the way and have proved their efficiency, the bigger things to come later will have much better chance of accomplishment, according to our informant who is an expert on military applications for glass laminates.

It is believed that Armed Force applications in 1951 required about 7 million lb. of polyester resin. It is expected that about 15 million lb. will be used in 1952. Included in the list of applications which will supposedly be produced in sizable quantity that will require that amount of resin are window glazing; construction helmets; Weapon A; and eleven different aircraft parts.

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If we should go to war and go all-out on production of these items, plus a few unnamed restricted jobs which have all been proved suitable, they might require as much as 72 million lb. a year, according to our informant. This figure does *not* include any allowance for boats.

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If certain other projects should firm up or prove out, the amount of resin needed for 1953 would go up by leaps and bounds. Among those applications which seem most likely to prove up in the year 1952 are the Chemical Corps' bleach containers which might be ordered in 8-gal. sizes at a rate of 200,000 a year. The prototype was OK'd and 1000 were ordered a year ago but not one was ever delivered. It is claimed that the contractor didn't have proper equipment. The job has now been let to another contractor.

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Other items in this list which seem most likely of quick adoption are the Air Corps' photographic carrying cases; a bomb cluster adaptor; pipe for naval boats; tanks to use on shipboard for water and diesel oil; parachute bins which are simply large racks built for parachute equipment; typewriter cases; survival seats for airplanes; antenna masts; wing tip fuel tanks for the Air Forces; the Navy's 9- and 16-ft. boats as well as a 26-ft. whale boat; and possibly a 57-ft. mine sweeper, two of which will be built this year and which each require 30,000 lb. of resin. Still another boat application is the Transportation Corps' 26- and 22-ft. boats as well as 105- and 50-ft. barges. The Transportation Corps is now procuring from 50 to 60 of their 26-ft. utility boats for harbor use, each of which would take about 1800 lb. of resin, according to our informant. It is said that the Transportation Corps would like to convert their whole fleet to polyester-glass boats. The Coast Guard is also said to be almost ready to procure 40-ft. cargo boats. Our informant thinks that if we were in all-out war, the above items, plus a few other polyester jobs, might require as much as 300 million lb. of resin a year, and he emphasizes that this estimate does not include some of the fantastic things that have been frequently talked about but are not deemed practical.

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The Navy has let development contracts to Auburn Button and Apex on the evaluation of low pressure glass and melamine combinations to find out their possibilities. The Navy is particularly interested in this material because of fire resistance and electrical properties.

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The Engineer Corps has spent around $10 million in experimentation on polyester-glass materials. One man says that they must now either produce or give up. None of the Engineer Corps materials or projects are mentioned in the above paragraphs. The farthest along of their projects that has received any publicity is the assault boat, but although it is successful as a transport, it is now learned that it will have to be redesigned if it is to succeed as a ponton boat which was one of the original reasons for which it was built.

Washington Notes

A new saran adhesive is now on 100% allocation by the Government, but will be handled by directives rather than the usual allocation order. The material is still in pilot plant operation and not available in great quantities. It is being used for coating the inside of ship tanks for fuel storage and for coating aircraft fuel cells. It is still relatively high in cost, but is non-corrosive and cuts down refinishing costs. In addition to The Dow Chemical Co., other firms involved in the production of this material are Minnesota Mining and Mfg. Co., B. F. Goodrich Rubber Co., Lenoir Wood Finishing Co., American Resinous Chemicals, and The Glidden Co.

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Ethyl cellulose is to be removed from regulation under Order M-32. It was placed there in the summer of 1951 and limited the amount of DO orders that any one company would have to supply to 40% of their production. At the present time, there is no shortage of ethyl cellulose; consequently, no control order is necessary.

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John Tokarz of Tennessee Eastman Co. has been appointed Deputy Director of the Plastics Section in the Chemicals Div. of NPA where he will be assistant to Lowell Kilgore, who has been head of the plastics group since NPA was organized. Mr. Tokarz represented Tennessee Eastman in Washington, D. C., during World War II and returned there in 1950 to handle company's relations with Government.

• • •

Ed Smith, who has been handling thermoplastics in the Plastics Unit of the Chemicals Div., has returned to Celanese Corp. of America, which had loaned him to the Government for duty when the Plastics Section was first set up. He will become assistant director of sales in the Transparent Films Department of the Plastics Div. of Celanese.

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The Bureau of Ordnance in the Navy Department is working on the development of a plastics container for rockets and shells which must protect the con-

tents against moisture. It is about 3 ft. long, and is used in various sizes from 3 to 8 in. in diameter. The container has a flanged-out top and a base that perhaps could be molded. The pipe shaped container may be extruded, wrapped, or formed in any other applicable manner. Present pipe is aluminum, but the Navy Department would like to have an alternate. The technicians are unfavorably impressed with thermoplastics because they want a material that will not burn. Most of the work up until now has been done with glass-polyester type pipe and a recently announced non-flammable polyester resin is now on test. The technicians say that they have found very little evidence to indicate that research work has been done on the moisture-vapor permeability of glass polyester resins and excellent mvp is needed for this particular job. The Navy is interested in finding other materials that might be suitable for this type of job. Development contracts are now in the hands of Camfield Mfg. Co. and American Fixture & Mfg. Co.

Polyethylene

Requests for polyethylene are still running about 250% of available material. The distribution in March was 36% to military; 35% to essential civilian; 29% to free distribution. Essential civilian use was down 4% from February and free was up 3 percent. Military was up 1 percent.

Essential civilian distribution may possibly continue to decline. For example, the increasing quantities of natural rubber now becoming available for civilian use will probably cut down the amount of camelback produced and thus reduce the need for polyethylene film used in its packaging. Other miscellaneous items such as closures for catsup, soy sauce, and the like, may also go onto the free list.

February and March availability was somewhat under January due to a temporary shutdown by one producer while tying in new equipment, but the installation came in ahead of schedule so that March supply was a little larger than expected. Starting in April, the supply will be about 150% more than June 1951 when polyethylene went on allocation. This doesn't mean that every user may get material at a rate of 150% compared to last June, because DO orders and essential civilian must be cared for first. The man with a DO order may get even more than 150% over his last June supply. Then, too, there has always been a fair supply of off-grade material which couldn't be used for film or wire coating but is good for mine pipe and molded materials—this situation too makes distribution a bit irregular.

Small Defense Plants

Up to March 1 the Small Defense Plants Administration has received 146 applications for loan assistance totaling $90 million. The government definition of a small war plant remains pretty much in the ethereal state as it always has. Our interpretation of Government's definition, boiled down to as few words as possible, is a small plant that has no particular stature as a controlling influence in the branch of industry to which it belongs. However, we have no idea of what might happen if one of the largest independent molding plants or calenderers in the industry should make an application for a small business loan. He would still be small business compared to a big steel company, rubber company, or chemical company, but he would be big in comparison to other plastics plants. We suspect he would get the loan if he could prove that he didn't have enough money to finance a Government contract which he claimed would be the difference between staying in and going out of business. It seems that he has to have that Government contract in hand before he can get a loan.

A prominent molder once said that in the last war 80% of the plastics molding was done by 10 or 15% of the molders then in business. However, these same molders sub-contracted a great portion of their work to other molders so that the entire thermosetting industry maintained a good rate of operation. Most of the thermoplastic molders had to depend primarily on civilian business. Indeed, a good number of thermoplastic molders were born in those days because they managed to get a Government contract by one method or another and, because they had this contract, were able to get an allocation for an injection machine.

A plastics operator who wants to find out about getting small loans should first apply for the Small Loans pamphlet on the subject which can be obtained at either SDPA or RFC field offices.

The first small loan made was for $80,000 to the J. C. Harmon Co., a wood working firm in Alabama. That company had a Government contract to make Army cots but needed additional equipment. When asked why they were granted this loan when there were all kinds of facilities in the hands of other small companies that could be used for making Army cots, SDPA officials said that "that was the law. SDPA is supposed to help any small company who has a Government contract that needs financing." It seems that if the companies who could make cots didn't bid on the contract, that was their privilege, but they shouldn't squawk about someone else being put into the business.

The first plastics company of record to get one of these loans is H. R. Koch Mfg. Co., a firm with 50 employees in Jackson, Mo. We believe this company succeeded the former General Plastic Molding & Plastic Seat Co. of St. Louis, Mo., about five years ago. According to a press release of February 14, they were granted a $36,000 loan "for working capital to carry out a defense contract involving compression molding of plastics materials."

MODERN PLASTICS

VOLUME 29 APRIL 1952 NUMBER 8

THE 'HARD' VINYLS

In a range of uses from chemical plant equipment to tough, thin film, the unplasticized polyvinyl chlorides are making great progress

Courtesy Industrial Plastics Fabricators

Intricate spray nozzle used in chemical plant work is entirely fabricated by welding hard vinyl sheet and pipe stock

WHEN Allied teams of plastics technologists went into Germany in 1946 they found that rigid, straight unplasticized polyvinyl chloride had been an important item in the Axis war production economy.

Vinidur, the chief German resin, with a Brinell hardness equal to that of aluminum, was used at a rate of 2000 tons a month, half of which went into chemical piping. (The plant which made it was torn down and is now presumably operating in Russia.) Luvitherm, a unilaterally stretched rigid polyvinyl chloride tape, was widely used in packaging of cheese and other items, in recording tape, and even in industrial belts.

Other German rigid polyvinyl chloride materials were used for insulation, while rigid copolymers were used for making transparent dials and windows, for battery cases, and in other moldings.

One characteristic common to all the German rigid vinyls was their high molecular weight. Another characteristic was their inability to be handled on universal equipment. The Germans used ram extruders which were slow and not continuous, and they used an early twin-screw extruder originally developed by Roberto Colombo of Italy.

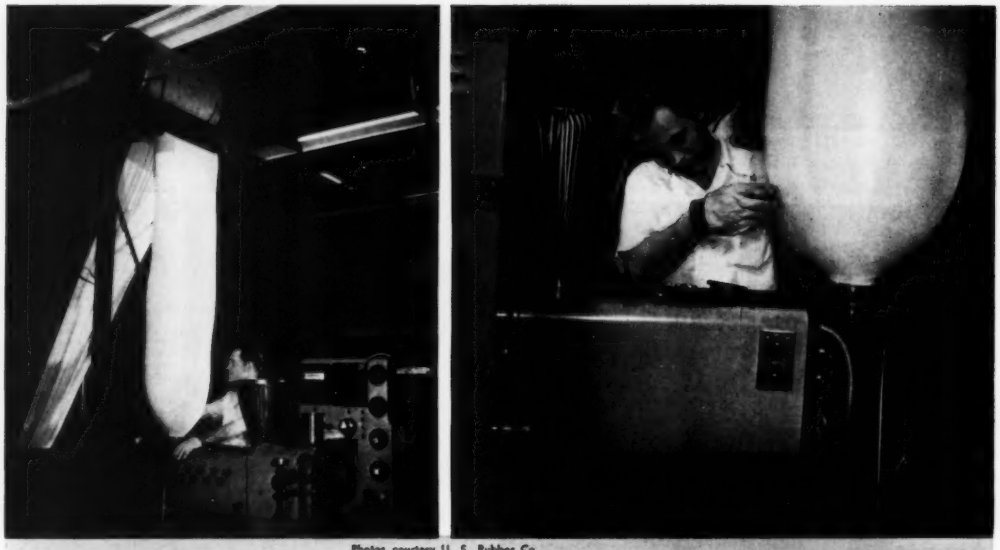
When the British went into production on rigid polyvinyl chloride, they found that the high molecular weight German-type materials wouldn't work readily on their single-screw extruders, because slow flow caused decomposition at high heats; so they developed Corvic LD, a low molecular weight polymer.

In the United States, up until recently, general opinion among vinyl men was that high molecular weight polymers could not be satisfactorily processed on our high-speed machinery. The original American rigid vinyl material, Vinylite, is a copolymer of vinyl chloride and vinyl acetate; a hard vinyl sheet made by Nixon Nitration Works, Nixon, N. J., is a similar type of material; still another member of the family, which is widely used in chemical pipe, is a copolymer of saran (vinylidene chloride) and vinyl chloride.

High Speeds Needed

It was a matter of using the rigid copolymers — or going to low molecular weight polymers. Yet the molecular weight of the polymer directly affects the softening point and mechanical properties of the product made from it. Needed were high molecular weight, rigid, unplasticized polyvinyl chloride polymers that could be handled at high speeds on relatively unspecial equipment.

On the U.S. market for the past



Photos courtesy U. S. Rubber Co.

Big market for hard vinyl film is foreseen in the packaging field. Film as thin as 0.0001 in. can be produced by blow-extrusion method shown above. Left: over-all view of a blow-extrusion setup, with squeeze rolls at top; at right is close-up of extrusion die

three years has been a high molecular weight, rigid polyvinyl chloride called Lucoflex, imported from France by American Lucoflex, Inc., New York, N. Y. It is sold in sheet, rod, tube, and molding powder form through fabricators such as Industrial Plastics Fabricators, Medway, Mass. (formerly Lucoflex Plastics Fabricators), Van Dorn Iron Works, Cleveland, Ohio, and E. L. Cournand & Co., New York, N. Y., who fabricate the material, chiefly for the chemical field where corrosion is prevalent. Lucoflex is a very successful material, and its use in textile manufacturing, air conditioning, battery manufacture, food processing, pulp and paper, gas processing, sewage disposal plants, and chemical construction, has created a broadened desire for more materials of the same type.

There are several problems involved in the making of rigid vinyls for the American market. First, there is the insistence of the end users that a high molecular weight material be provided. Second, there is the insistence that the resin be processable into sheet, rod, and tube form on regular, mass-produced equipment, including single screw extruders. Third, there is the typical American demand for colored rigid vinyls. Fourth, there is the likewise typical American demand for a wide range of properties in a "line" of rigid polyvinyl chloride materials. This latter factor means that this market requires different specialized levels of rigidity, so that the American versions may include more modifying agents than are used in Europe.

Thus, the industry has developed here along the lines indicated by the general term "hard" vinyls, as used in the title of this article, as differentiated from "rigid" vinyls.

While every major producer of vinyl resins is working in this field, two of them have announced specialized resins for the market and are actively selling them. The resins are quite different. One is Geon 404, by B. F. Goodrich Chemical Co., Cleveland, Ohio; the other is Marvinol VR-10, by Naugatuck Chemical Div., U. S. Rubber Co., Naugatuck, Conn.

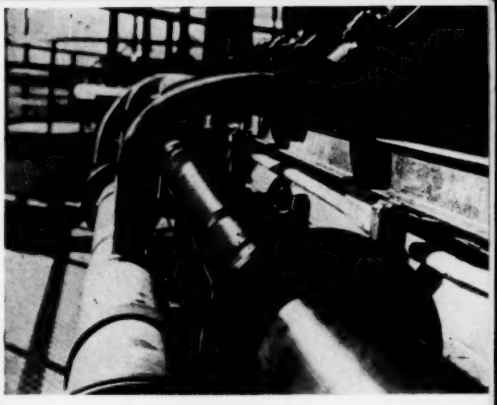
"Hard" Vinyl Defined

In order to avoid later polemics, Modern Plastics secured the cooperation of development research executives in both of these companies in working out the following definition:

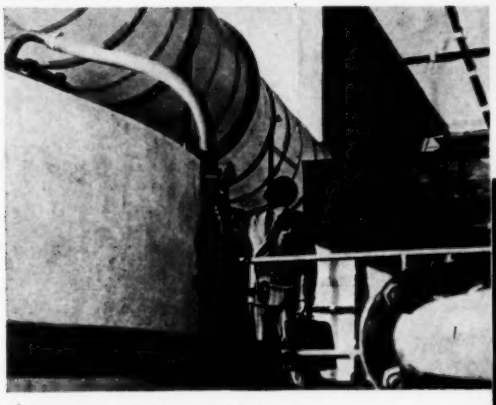
"A 'hard polyvinyl chloride' is a compound having high chemical resistance, hardness, and softening temperature (70 to 85° C.), and is constituted essentially of a high molecular weight-high vinyl chloride content (90 to 95%) resin. Small amounts of modifying agents, such as other resins or rubbers, plasticizers, fillers, stabilizers, lubricants, and colors, may be added only to the extent that the previously mentioned properties are not significantly lowered — for example, a reduction in softening temperature of not more than 2 or 3° C."

The chief purpose of having good inherent stability in hard polyvinyl chloride resin is to prevent catalytic degradation of the compound by internal frictional heat developed in compounding and extrusion. Since extrusion work is of such importance to all markets for the hard vinyls, and since many processors want to put the material through standard and conventional equipment, it has become necessary to improve stabilization and lubrication. These com-

ITALIAN PROGRESS WITH RIGID VINYLS



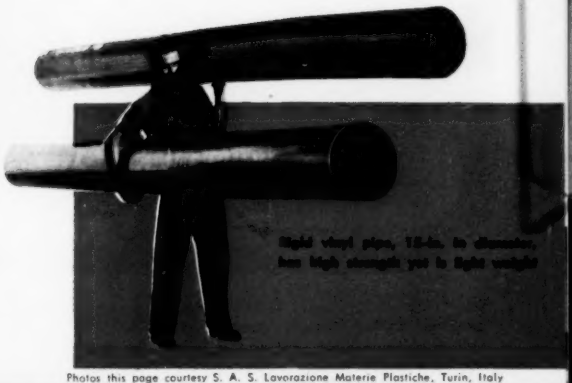
Piping in a chemical processing plant



Piping for gas suction in a perphosphate plant

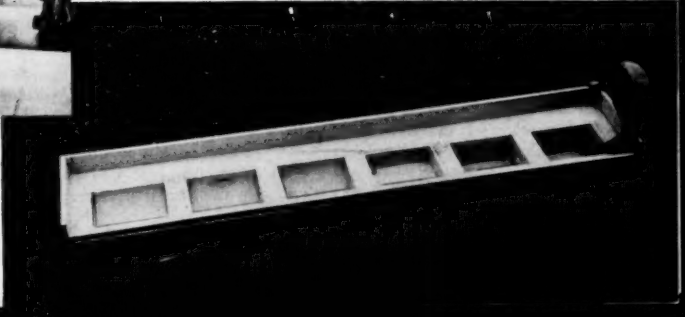
Examples of joints in rigid vinyl pipe

Fabricated coil for cooling hypochlorite

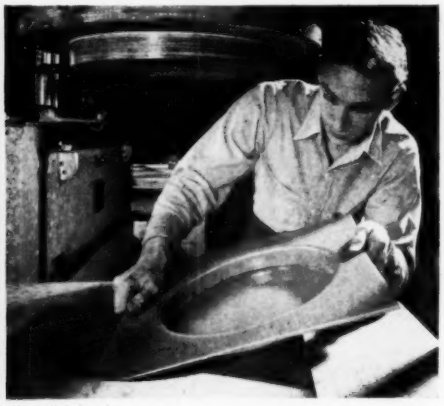


Photos this page courtesy S. A. S. Lavorazione Materie Plastiche, Turin, Italy

Right-angle joints in large rigid vinyl pipe



Rigid vinyl tank for chemical use



Photos these two pages courtesy H. N. Hartwell & Son, Inc.

Sheets of hard vinyl are easily formed with simple equipment after preheating in a circulating air oven or under infra-red lamps

Sheet formed with male and female dies. Other methods that may be used are free-blowing and vacuum snap-back

FABRICATING AND WELDING HARD VINYL STOCK

Hard vinyl may be sawn with conventional equipment, but local over-heating must be prevented. It is highly recommended that saws with fine teeth and no set be used

pounds, unlike other thermoplastics which have fairly sharp melting points, soften only to a dough or putty state even when heated beyond optimum extrusion temperature.

Therefore special extrusion conditions are necessary on single screw machines. Naugatuck Chemical recommends the following:

Extruder: A plastics type with streamlined flow conditions is recommended.

Screw: Use a shallow screw with a full flight: do not cool the screw; large screws should be heated if the external heat from the barrel is insufficient to effect fusion.

Breaker Plate and Spider: Both should have large perforations for streamlined flow.

Screens: None or no finer than 40 mesh for general use.

Bleed on Crosshead: Use a bleed valve instead of a plug valve.

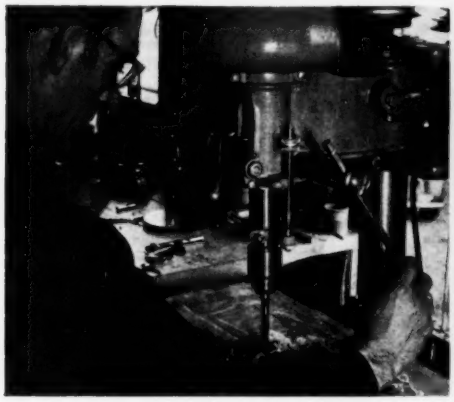
Die: An extended die with a heater at the end is preferred.

Die Temperature: 390 to 410° F. for high gloss.

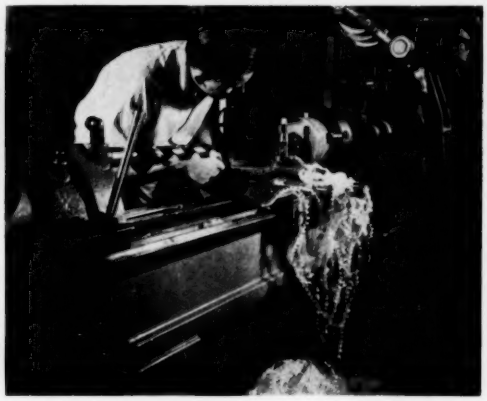
Stock Temperature in Barrel: 340 to 350° F.

Stock Temperature at Outlet: 370 to 390° F.

Having the back end of the torpedo (just in front of the screw end) tapered has been found to prevent collection of compound, which could be degraded by over-heating at that point. All of the conditions outlined above are intended to increase the



In drilling hard vinyl, standard drills and feeds can be used. The piece in work must be held firmly in position



When turning, ordinary metal-cutting tools should be modified by increasing clearances to reduce heat and facilitate chip removal

Welding makes it possible to fabricate hard vinyl into almost any assembly. The process is similar to metal welding or brazing and makes use of a hot-air gun

Close-up of welding operation. All types of joints—face, plug, lap, etc.—are possible

temperature of the stock progressively, until it reaches the optimum range of 370 to 390° F. at the die outlet. When any discoloration occurs, through frictional heat in the barrel or through over-heating, temperatures should be lowered gradually.

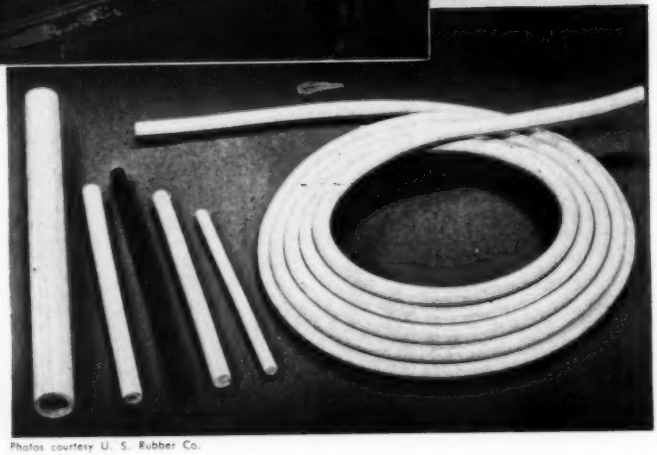
Because of the low plasticity of these compounds, their conformance to die shape is excellent and close tolerances can be held. The compounds expand slightly as they leave the die and can be drawn down only moderately.

Of course, with twin- or triple-screw extrusion, there is no opportunity for back-up of material in the extruder at points where degradation through over-heating would occur.

Preparing for Processing

In general, hard vinyls must be "plasticized" by mechanical working to get them into a plastic, flowable condition. In other words, dry mixed compound is not preferred for feeding to an extrusion, molding, or calendering operation. However, chopped compound can be used and the initial work is generally done in a Banbury or on a mill where the proper stabilizers, lubricants, fillers, and colors can be added. The mechanical working thus achieved is more important to hard vinyls than it is to the soft plasticized stocks which flow and knit together much fast-

Left: Extruding hard vinyl rod. The material must first be "plasticized" by mechanical working to get it into a flowable condition. Examples of rod and tube extrusions are illustrated below



Photos courtesy U. S. Rubber Co.

er. After hard vinyls have been milled, the sheets must be cut into small pieces for further processing, and this must be done while the stock is warm because these materials are so tough that granulation after cooling is almost impossible. Or the unplasticized powder can be extruded into small rods, which are then chopped into short lengths. The rods are passed through a short water bath to chill the surface before chopping, to prevent the individual pieces from sticking together.

Once the hard vinyls have been processed into sheets, rods, and tubes, they may be fabricated by relatively standard methods, welded with hot air guns, and heat formed at from 90 to 125° C., depending upon the depth of draw.

But good fabrication must have standards and instruction back of it. American Lucoflex, early in its marketing program, found that it had to teach and supervise fabrication and welding techniques in order to protect the good name of its material. The Bolta Co., Lawrence, Mass., in bringing out its Boltaron 6200 hard p.v.c. sheet, rod, tube, and molding compounds (Bolta's development benefited from the experience of its German factory, Bolta Werk, GMBH, which has worked closely with Badisch Anilin and Soda Fabrik, Ludwigshafen, Germany), is taking an important step to prevent misfabrication. Industrial Plastics Div., H. N. Hartwell & Son, Inc., Boston, Mass., is the exclusive distributor of Boltaron 6200, and this company, through Industrial Plastics Fabricators, is setting up a training system under which it will certify the ability of a fabricator to use the material—and will not sell anyone who is not qualified to do the work.

Broad Markets

Markets for the hard vinyls are so broad, it is difficult to assess them by comparison. And there is so much more that can be done with the "hard" versions than with the "rigid" versions, that material at every level of hardness may be expected to find its own fields.

First, of course, is the huge market for hard vinyls to replace stainless steel and other scarce and expensive metals in the chemical processing industry. Most of the fabricators such as American Agile Corp., Cleveland, Ohio; Murray Products Inc., Cleveland, Ohio, with its Polydur material; Van Dorn Iron Works; and Sill Industries, New York, N. Y., are concentrating at present on this market. Chemical companies such as E. I. du Pont de Nemours & Co. have been using the rigid vinyls for years, and increasing amounts are going into the synthetic textile field, acid industries, food processing, and all other places where flame resistance, light weight, corrosion resistance, and price are factors.

In the industrial field, in the U. S., however, there is still much progress to be made in comparison to what is being accomplished in Europe. The photographs on page 89, sent to Modern Plastics by Roberto Colombo, famed extrusion expert, illustrate this fact. For flume stacks in the U. S., it is still necessary to fabricate sheet materials, while in Europe they are regularly extruded up to 22 in. in diameter, continuously.

More Know-How Needed

But there are markets for the hard vinyls in America that are peculiarly American and are awaiting development. No other nation uses anything like the quantity of packaging film that the U. S. does, and

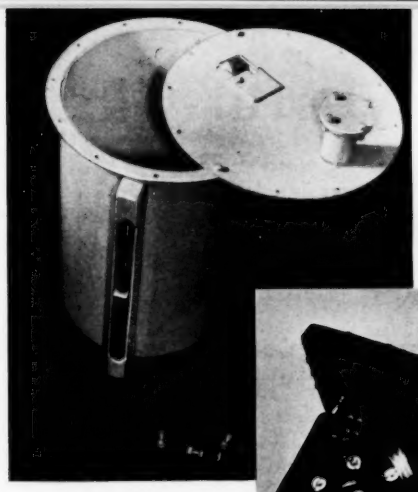
some hard vinyls can be blow-extruded into clear transparent and very tough film as thin as 0.0001 inch. Obviously, once know-how has been broadened to the field, there will be a big market for this material in packaging.

Extrusion of hard vinyl over metallic and non-metallic cores lends toughness and beauty to stanchions on buses and to metal furniture. The same application is also useful for covering structural metal supports in explosive factories to minimize sparking.

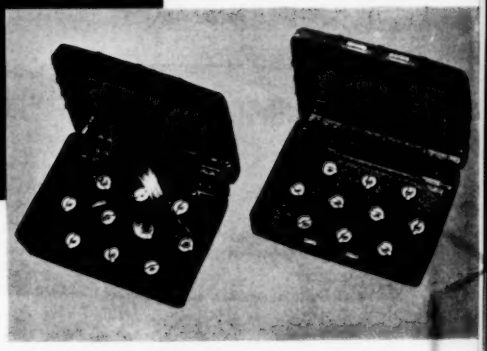
With Geon 404, Goodrich is putting much effort behind wire coating where the material stands up to elevated temperatures and is so tough that it can be used as primary insulation for military field wire, eliminating the need for jacketing. It is quite possible, through crosshead extrusion, to include spiral wire in semi-flexible piping, to take care of static. The electrical properties of the hard vinyls are excellent, and these, in conjunction with abrasion and deformation resistance and both low and high temperature strength, make the materials attractive to the electrical industry.

Naugatuck Chemical engineers have developed a new high speed method of laminating hard vinyls to steel and other materials, an advancement which will afford designers the opportunity of incorporating a high structural strength material with outstanding chemical and solvent resistance in new and existing equipment. Because the vinyl can have very attractive coloring, the laminate can provide a permanent finish of lasting beauty; the formability of relatively cheap sheet metal is improved by the vinyl lamination.

Since the hard polyvinyl chlorides can be drawn and compression molded, they have further prospects in housing applications and containers. Typewriter cases, business machine shells, tote boxes, and similar items may be made of relatively thin sheet hard p.v.c. The weather resistance of these materials makes them suitable for a whole range of outdoor applications not even being given any attention at present. In rifle butts, farm machinery, builders' hardware for the tropics, and permanent coating for exposed structural metals, will lie a whole new group of markets.



Designed to hold a corrosive fluoride used in water fluoridation, this hard vinyl tank has extreme chemical resistance



Right: Fishing lure boxes molded of hard vinyl. In this model, small inserted magnets hold the flies

Trays, scoops, fume hoods, piping, and decorative corrugated sheets are all produced from hard vinyl. Applications are especially effective where corrosive chemicals are encountered

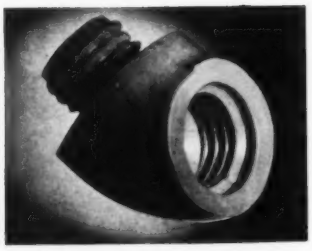
Photos above courtesy B. F. Goodrich Chemical Co.

Laminates composed of hard vinyl on metal offer many new structural possibilities. Fabricated items below, many with crimped joints, were made from such a laminate

Courtesy U. S. Rubber Co.

New Polyester-Glass Compound

Features include ¾ in. fibers, good flow at very low pressure, long shelf life, and superior finish



Electrical adapter for aircraft antenna was experimentally plunger molded

GLASS fibers ¾ in. long serve as reinforcement in a new polyester-Fiberglas molding compound developed by Atlas Powder Co., Wilmington, Del. The new compound is suitable for compression or transfer molding and is said to have good flow characteristics, even at low pressures, despite the length of the fibers.

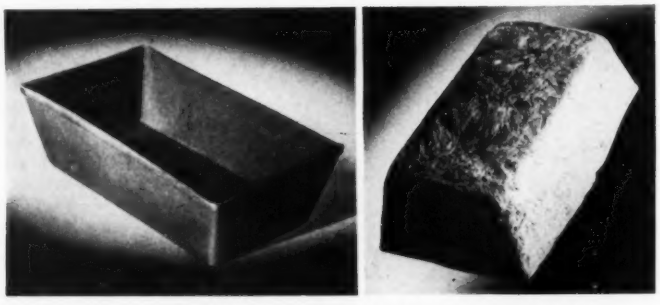
Electrical parts, switches, connectors, relay cases, and similar parts are among the applications foreseen for the new compound. The manufacturer also believes that the material will prove useful for compression molding pieces which are too intricate to preform economically.

The compound is approximately 30% glass by weight and also contains a mineral filler. Pieces have been molded at pressures ranging from 75 to 5000 p.s.i., and at molding temperatures of 250° to 350° F. Cycles run on the order of 2 min. for a ⅛ in. section molded at 250° F., and are correspondingly shorter when higher temperatures are used.

The molded pieces have a superior finish and are highly resistant to water, acids, alkalies, and bleaching agents. The pieces can be machined with the same tools and techniques used on polyester laminates.

Items molded of the new compound have a heat distortion point of about 300° F. and a flexural strength of 16,000 p.s.i. Impact strength is approximately 10 ft.-lb. per in. of notch.

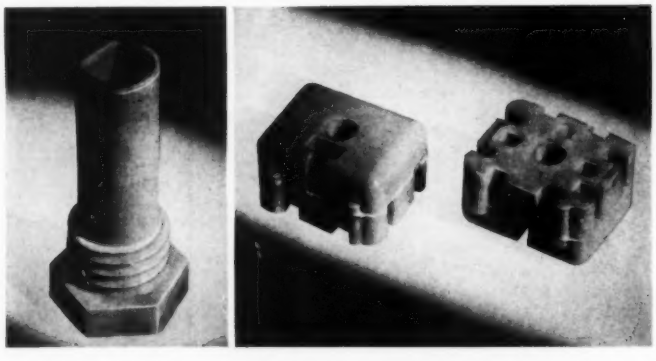
The flow characteristics of the material are demonstrated by the accompanying photograph of a 4-in. long molded box and of a similar box with the resin burned off in a muffle furnace. The even distribution of the Fiberglas reinforcement throughout the piece becomes obvious when the resin is removed.



Left: Box four in. long molded of new compound. The glass fibers are 30% by weight of finished box. Right: Box with the resin burned off shows an even distribution of fibers

Among the parts which have been molded are a threaded brush holder and a carrier, both of which were plunger molded by Continental Can Co., Cambridge, Ohio. The carrier, which is about 1 in. long, is molded in a 20-cavity die from a central sprue to a plunger pot. An electrical adapter for aircraft antennas was molded experimentally by Kurz-Kasch, Inc., Dayton, Ohio, for Dayton Aircraft Products, Dayton.

At present, the compound is available in a putty-like form but the manufacturer expects to make the material available in a drier form in the near future to facilitate handling. The shelf life of the compound is about three months.



Plunger molded electrical parts include threaded brush holder (left) with abrupt changes of section and carrier (right) molded in 20-cavity die from central sprue to plunger pot

Styled for Acetate

Floor polisher has strong acetate housing; its nylon gears are quiet, reduce maintenance

Molded cellulose acetate housing for electric floor polisher combines heat-resistance, dimensional stability

Light weight and compactness of acetate housing improves maneuverability of floor polisher; nylon gears reduce noise of operation and need no oil

DESCRIBED as making "the bucket and scrub brush as obsolete as the bustle," the new Super 8 electric floor polisher and scrubber, by S. C. Johnson & Son, Inc., marks the latest development in the company's 25 years of experience with electric polishers. The Super 8 has the first molded plastic housing ever used on a Johnson polisher and also uses nylon gears. The sleek exterior styling was done by Palma-Knapp Assoc., Chicago.

The molded plastic housing made it possible to specify a compact, deep draft piece which would have been difficult, if not impossible, to duplicate with a drawn metal shell, while keeping weight at a minimum. Integral color (grey) eliminates costly finishing operations, and the molded housing will stay smart looking after years of normal service.

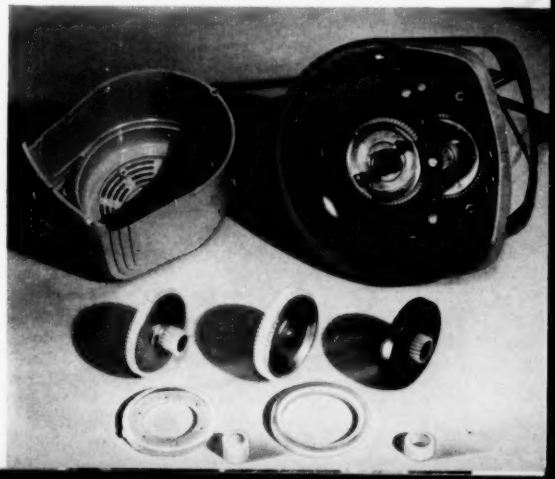
Details of Housing

Essentially circular in design, the acetate housing measures $6\frac{1}{8}$ in. across, $7\frac{3}{4}$ in. from front to back, and $5\frac{3}{4}$ in. high. The top of the piece carries a ventilating grille or louver formed of concentric slots and ribs and measuring $4\frac{1}{4}$ in. across. Air drawn in at the bottom of the appliance to cool the motor is exhausted through these openings. Depressed lettering molded into the top of the housing is wiped-in in dark grey for increased legibility. The housing assembles to the metal base of the polisher by means of three bolts which screw into threaded metal inserts in the acetate casting.

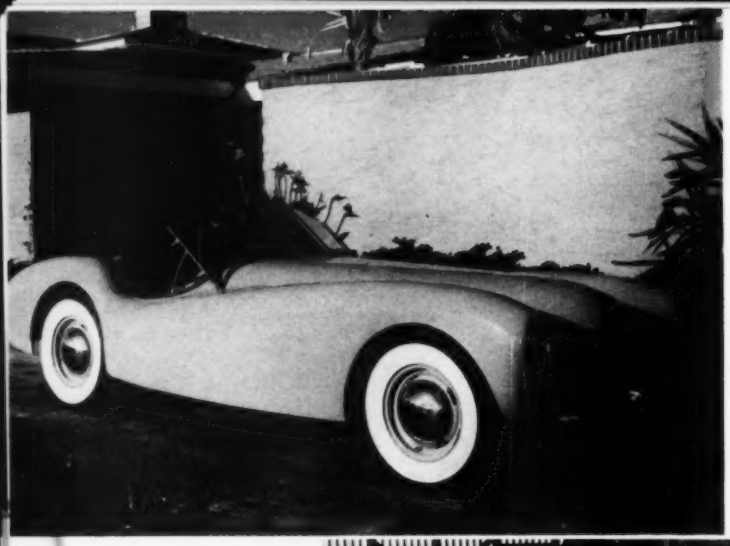
The wall section of the housing, distributed in accordance with mechanical strength requirements, ranges from 1/16 in. up to 5/32 inches. Four of the eight radial ribs of the louver have cored bosses on the underside, permitting a circular metal dust shield to be fastened in position by means of thread cutting screws. A semi-circular core in the rear skirt portion of the housing provides an opening for the electric cord. An interesting design feature consists of the small streamlined extension rising about ¼ in. above the top of the domed housing. This projection contacts a stop on the stirrup-type handle support, preventing the handle from falling forward when lifted up slightly past the vertical and released.

The housing, which weighs approximately 8 oz., was specifically designed to be molded of flame resistant grade cellulose acetate and was originally molded of Celanese XF until that material was withdrawn from the market. Since that time, it has been molded of a specially formulated Hercules cellulose acetate combining high heat resistance, maximum hardness, and dimensional stability. The housing is produced by Chicago Die Mold Corp. on an 8-oz. press of the company's own design, having more than normal clamping action and an unusually large die space which accommodates the deep draft of the

(*Continued on p.* 178)



Gears (2nd row) hobbed from molded nylon blanks (1st row) are located beneath polisher motor (upper right); housing (upper left) attaches to unit by bolts screwed into threaded metal inserts

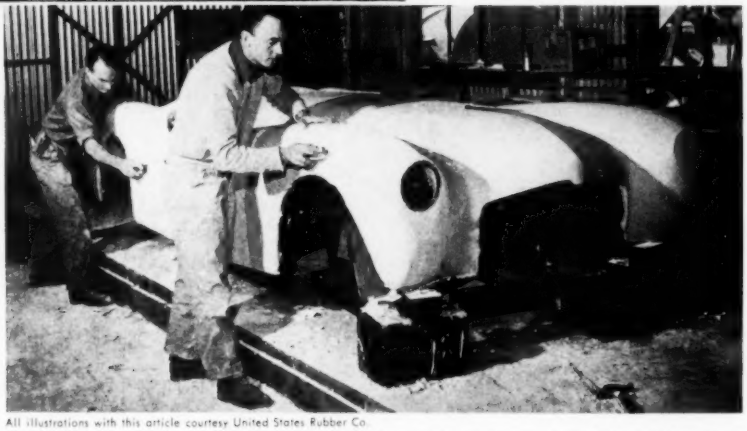


PLASTIC

THE long awaited and much talked about plastic automobile body is here. Commercial production of a sports car body has been announced by Glasspar Co., Costa Mesa, Calif. This body, initially being produced in one design which fits a frame with a 100-in. wheelbase, is of reinforced plastic construction and hence is dent-proof, rust-proof, strong, and light in weight.

The present type body sells for $650; as production increases, pres-

Sleek, clean lines characterize the reinforced plastic body now being put into commercial production for mounting on a chassis with 100-in. wheelbase



All illustrations with this article courtesy United States Rubber Co.

No expensive molds or heavy machinery are necessary for manufacture of new plastic body. Initial step is to make wood and plaster male master, which sets shape of body. Production mold is made from this master

Flanges of glass cloth and resin are attached to female mold to assure proper positioning of halves after removal from master

Molding surface of female mold is sanded to as smooth a finish as possible. This surface imparts its finish to the surface of finished body

CAR BODY IN PRODUCTION

ent plans foresee the availability of a variety of automobile body styles which will be able to fit frames of various sizes.

The body, molded in one piece in a female mold, is approximately $\frac{1}{5}$ in. thick and weighs only 185 pounds. The polyester material used in conjunction with fiberous glass mat and cloth is Vibrin produced by Naugatuck Chemical Div., United States Rubber Co. Two layers of glass mat and two layers of cloth are used; the resulting structure is approximately 65% polyester and 35% Fiberglas.

Production Steps

The female production mold is made on a wood and plaster master which is given an extremely smooth finish. This step is necessary because the master mold imparts its finish to the female production mold and hence, ultimately, to the final body.

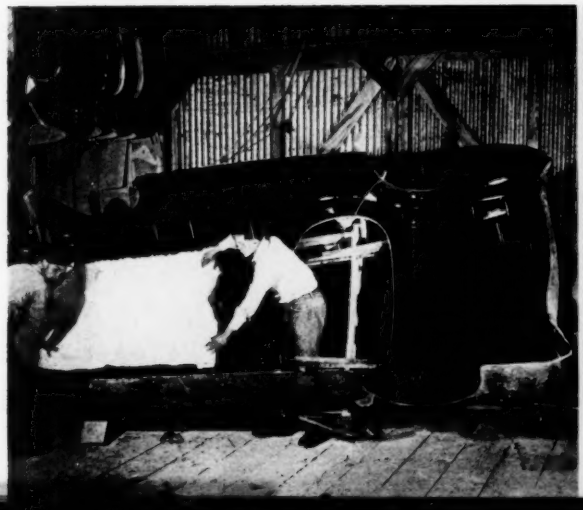
After the master mold is waxed and coated with a parting agent, a fast-curing coat of polyester is applied as an overlay. This assures a smooth finish, free of pinholes and rough spots, on the female production mold. Layers of glass cloth and mat are then laid up dry over the cured polyester coat, and additional polyester is applied to impregnate the cloth and mat. Squeegeeing is used to remove air bubbles and to evenly disperse the polyester.

Before the female mold is put into

In building the female production mold, layers of glass cloth and mat, applied over a coating of polyester resin, are impregnated with additional resin

After curing, the female mold is cut apart near the driver's seat for easy removal from the wood-plaster master

The sanded female mold (see also photo at left) has been coated with parting agent and initial layer of resin. Workmen are starting lay-up of glass mat



Laying glass cloth over the mat. After lay-up for body is complete, mat and cloth are impregnated with resin

Curing of the fibrous-glass polyester car body is speeded when necessary by the use of infra-red lamps. Most of the cure takes place at room temperature and no pressure

Molded body comes away easily from the female production mold. Note smooth finish on body, at left in photograph

Portable sanders are used to smooth corners and surfaces of body before painting

production, it is carefully spot finished to be sure that its molding surface is perfectly smooth. Production of the final body is similar to that of the female mold: waxing, application of parting agent, an overlay of fast-curing polyester, lay-up of glass cloth and mat, impregnation with polyesters, and squeegeeing. The body is cured in the female mold, with infra-red lamps used to speed the curing process as needed.

While present production methods at the Glasspar plant are still far from mass production as used in the automotive industry, they hold out the following highly desirable factors: elimination of expensive molds and dies, elimination of heavy and expensive machinery, and a greater freedom of design. When these low-cost production methods and equipment are teamed up with desirable strength and wearing qualities, the plastic body offers potentials which cannot be ignored.

Although the reinforced plastic in this motor car body is dent-proof, it is possible, of course, to break the material under heavy impact. Such breaks can be easily and inexpensively repaired. As shown in the group of photographs on the opposite page, one of the Glasspar body cars was deliberately driven into a tree at a speed of approximately 25 miles an hour. This resulted in a jagged break in one of the fenders. The break was repaired in about an hour; cost for materials was about 50 cents.

Polyester-glass sports car body weighs only 185 lb., yet its strength and resiliency eliminates need for heavy, complicated reinforcing ribs and frames under the body

REPAIR WORK ON PLASTIC CAR BODY IS SIMPLE, INEXPENSIVE

Test car was run into a tree at 25 miles per hour. Fender was not dented, but suffered a 14-in. long crack

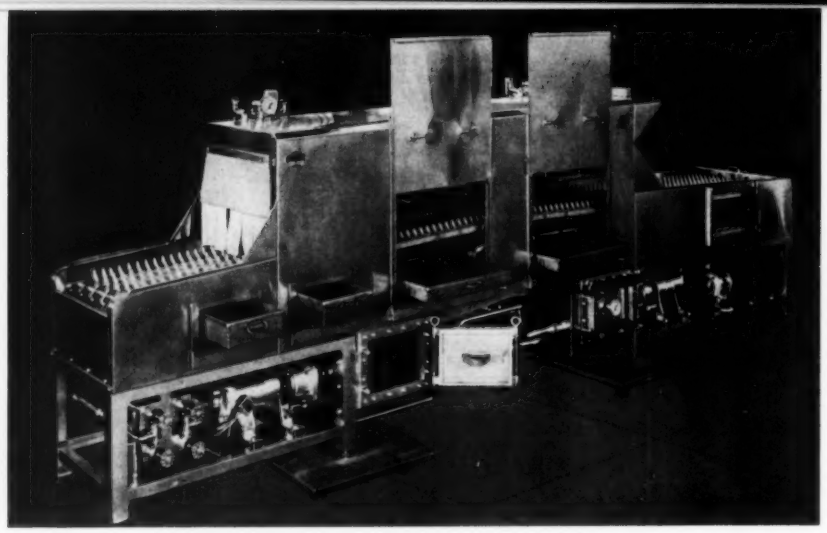
First step in repair of crack was to grind edges so that a firm patching bond could be obtained

Patch for crack was prepared by cutting a piece of glass cloth sufficiently large to cover the damage

Trimmed patch of glass cloth was then laid over the crack and thoroughly coated with polyester resin

Time required for curing patch can be reduced by subjecting area to heat from battery of infra-red lamps

After patch is cured, area is sanded and painted. Total patching time: 1 hour. Material cost: 50¢



Dishwasher conveyor is formed by interlocking nylon links and rides on molded nylon rollers; approximately 50 lb. of the plastic is used in producing this model

Molded Nylon Improves Dishwasher

ALTHOUGH the use of injection molded nylon for coil forms, bearings, highly stressed electric shaver parts, and other small components has increased rapidly during the past couple of years, most applications have involved only a few ounces of the material per piece. Recently, G. S. Blakeslee & Co., Chicago, manufacturer of kitchen machines since 1880, has pointed the way to large-scale new applications with a commercial dishwashing machine conveyor composed almost entirely of molded nylon. Even the smallest of the conveyors used in the various washers requires approximately 50 lb. of the plastic.

Wood Replaced

Blakeslee's interest in molded nylon grew out of the company's favorable experience with this material in another type of dishwasher conveyor originally made consisting of maple slats joined by brass links, with upright maple pegs to hold dishes, cups, and other items in position as they were carried through the machine. Despite the efficient operation of the conveyor, maple tended to deteriorate under the combined action of detergents and water at temp. from 180° to 200° F., and maintenance became a problem.

Efforts to overcome these difficulties first led to the adoption of phenolic laminate pegs to replace those made of maple. Another forward step was the elimination of the wooden slats in favor of molded phenolic slats having greater dimensional stability and superior resistance to detergents, water, and high temperatures.

Next came the replacement of phenolic laminate pegs with molded nylon pegs, which exhibited superior characteristics. Their smooth surface and resilience protected the chinaware against damage, while their resistance to hot water and detergents made them practically indestructible in normal service. Used by the hundreds in the impeller type machines, these pegs soon convinced Blakeslee engineers that nylon was a natural for this application. It was logical for them to turn to nylon in developing a conveyor for a new pump type machine which sprays the chinaware from above and below, rather than from the side, and requires an open style conveyor through which washing solutions and rinse waters will pass freely.

The conveyor in the pump type machine is all molded nylon except for transverse brass rods which join the plastic sections together and the stainless steel links connecting adjacent rods at the outer ends. No metal parts of the conveyor touch the dishes; all contact is with the nylon.

The plastic sections are of two types, basically alike except that one has two integral upright fingers on the top surface, while the other has one small vertical projection $\frac{7}{16}$ in. high. When assembled in the proper pattern by passing the brass rods through them, the links form an endless conveyor with alternating rows of continuous slots which hold plates, trays, etc., upright for efficient washing, rinsing, draining, and air drying. The intermediate links provide further support for cups, bowls, etc., and prevent even small pieces of china from falling through.

No Lubrication Needed

The entire conveyor rolls on molded nylon rollers $\frac{3}{4}$ in. long, with an outside diameter of 1 inch. Spaced at regular intervals along the sides of the conveyor, the rollers travel on extruded brass tracks and require no lubrication. Due to its linked construction, the entire conveyor is flexible, permitting it to double back at the end of its travel and return in an inverted position to the loading end of the machine.

Company officials report that the

nylon conveyor has performed even better in actual service than indicated in preliminary tests. Several of the machines are now operating in large hospitals, schools, etc., and others are being built. A typical machine, the Model 85PT-2, will wash 10,000 to 18,000 pieces per hr. and is used in places feeding between 1000 and 2000 persons per meal.

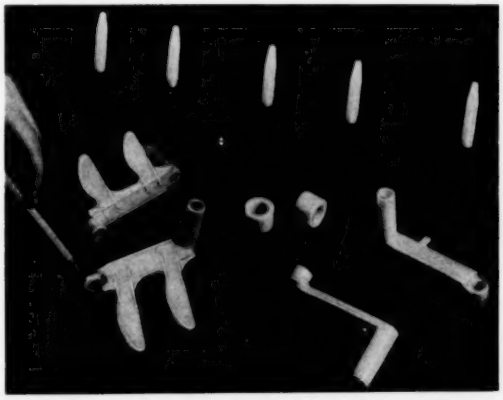
Examination of conveyors which have been in use for a number of months reveals no perceptible wear. The strength and light weight of the molded nylon permit a conveyor design with maximum open space for efficient washing, rinsing, and drainage of the dishes. The light weight of the conveyor means that there is a minimum of "dead weight" drag; the conveyor is driven by a ½ hp. motor at a speed of 10 ft. per minute. If necessary, the plastic links can be easily removed and replaced.

The self-lubricating nature of nylon gives the plastic conveyor another plus value. Whereas lubrication and rusting would be a serious problem in a conveyor of metal construction (since the hot water would remove the lubricating grease and carry it into the washing and rinsing solutions), the nylon conveyor actually makes use of the water as a lubricant. In addition, the smooth surface of the nylon links will not pit or corrode to form pockets for food particles and grease.

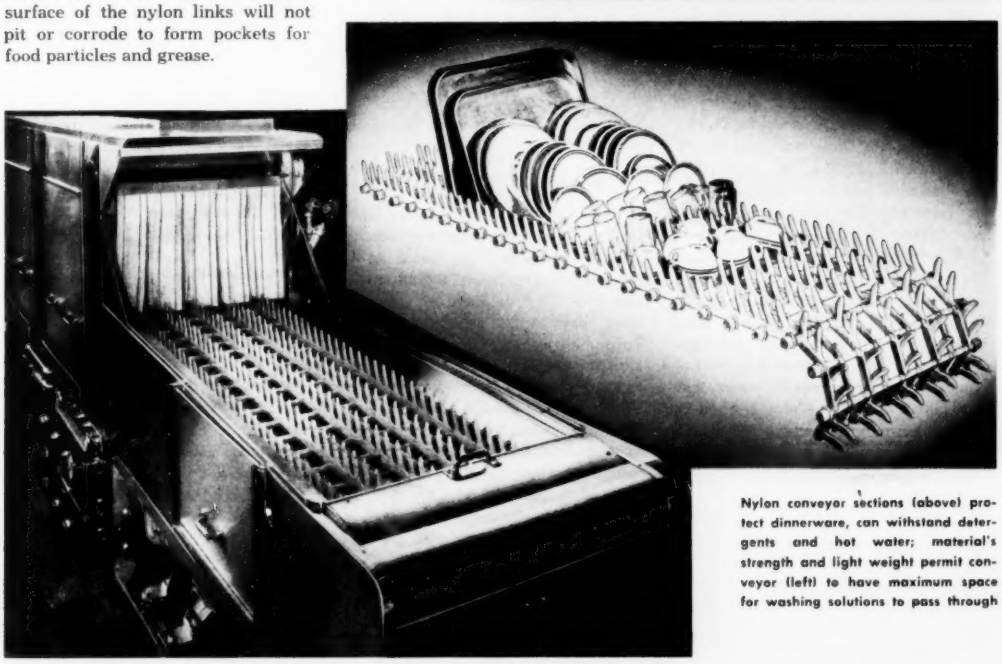
Phenolic slats used in the Blakeslee impeller type machines are molded by the Richardson Co., Melrose Park, Ill. All the nylon conveyor parts are produced by Hauser Products, Inc., Chicago. The rod-like uprights which are used in combination with the phenolic slats are produced in an eight-cavity die. Molded nylon slats are now available to replace the phenolic slats.

Molding Data

Two molds are used in turning out the sections for the new nylon conveyor. A two-cavity mold makes the links having the large upright fingers, while the other, with four cavities, makes two of the plain links and two rollers per cycle. The parts are run on an 8-oz. Reed-Prentice machine. Cam-actuated side cores with minimum draft form the horizontal openings through which the brass tie rods pass. Maximum strength and dimensional stability of the nylon parts, according to the molder, are obtained through a combination of proper cycle and mold temperature control.



Nylon pegs in molded phenolic slats (top) are used in one conveyor; other type has nylon links joined by metal rods through openings (pencil point) and uses nylon rollers (center)

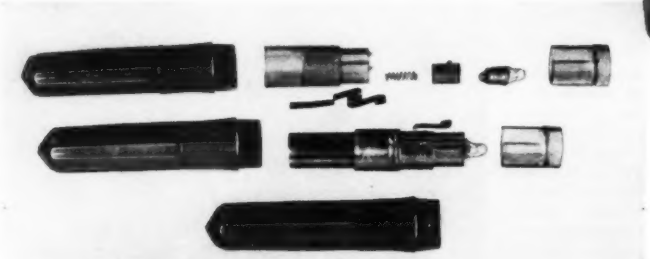


Nylon conveyor sections (above) protect dinnerware, can withstand detergents and hot water; material's strength and light weight permit conveyor (left) to have maximum space for washing solutions to pass through

Throw-Away Flashlight

Elastomeric vinyl case is electronically sealed to rigid vinyl lens to form a hermetically sealed unit

Hermetically sealed flashlight is only 4 in. long and 7/8 in. in diameter. The switch can be worked through the elastomeric vinyl case



Components of flashlight include (top row, left to right) vinyl case, styrene copolymer inside piece, spring, bulb collar, bulb, and vinyl lens. Switch is below styrene piece

THE flexibility, rigidity, transparency, and sealability of vinyl made possible the development of a compact, efficient, hermetically sealed, disposable flashlight for military use. The flashlight, made by the Battery Div., P. R. Mallory & Co., Inc., North Tarrytown, N. Y., has its mercury cell, bulb and switch mechanism inside a one-piece molded elastomeric vinyl case which is electronically sealed to a rigid vinyl lens.

The flashlight is only 4 in. long and 7/8 in. in diameter. It can thus be carried in a pocket and is always ready to provide sufficient light for map reading, emergency repairs to equipment, etc. It is unaffected by moisture, even submersion in water, and has a continuous service life of 12 hr., which may be as long as several years of ordinary flashlight service. It is simply thrown away when it gives out.

The new flashlight was designed by Mallory to meet the military demand for hermetically sealed flashlights which would not go dead before they were used because of the relatively short life of dry cells.

Mallory had a mercury cell with unusually long shelf life. The company then developed a simple switch which could be sealed within, yet worked through, a flexible material. The switch permits either intermittent or continuous operation of the flashlight, according to the amount of pressure applied to the flexible case.

Flexible Material Needed

For the case of the flashlight, Mallory needed a material flexible enough to allow the switch to be worked by pressure on the outside of the case. The material, at the same time, had to be capable of being permanently bonded or sealed to a transparent lens. The ideal answer to the problem turned out to be vinyl—an elastomeric opaque vinyl for the case and a rigid transparent vinyl for the lens.

The job of molding the elastomeric vinyl case was given to Hungerford Plastics Co., Rockaway, N. J. The case is molded in a 2-cavity die with two sets of removable cores so that one shot can be molded while the pieces from the previous shot are being stripped from the cores by the press operator. The rigid vinyl lens is molded by Mallory in a single-cavity die on a 2-oz. Van Dorn machine.

A third plastic piece for the flashlight serves to hold the bulb, cell, and switch in the proper position. The cell fits in one end, the bulb assembly in the other, and the spring strip switch slides into a dove-tail slot molded-in to the side of the piece. This piece is molded by Mallory of transparent Bakelite C-11 styrene copolymer.

Special Sealing Jig

The problem of getting a continuous seal around the circumference of the flashlight between the lens and the case was solved with the cooperation of Radio Receptor Co., Inc., New York, N. Y. The sealing jig holds the flashlight in a vertical position while four horizontal electrodes close in. The electrodes are shaped so that their edges form a circle when they meet. The diameter of the circle is smaller than the outside diameter of the vinyl case so that the wall of the case is compressed half its thickness at the point of sealing. The sealing cycle is six seconds.

Photos courtesy General Electric Co., Chemical Div.

One-piece seamless construction of melamine-surfaced laminate kitchen unit results in a neat and easy to clean installation

Uninstalled kitchen work surface shows smoothly rounded corners, integral backsplash, and shape of dripless front edge

COUNTER TOPS *molded to shape*

Melamine-surfaced laminate unit, with dripless front edge and integral backsplash, eliminates dirt-catching corners and cracks

by L. G. DERBYSHIRE*

THE kitchen work surface, which takes the most abuse of any piece of furniture in the home, has long been the target for new materials. Years ago, pine, oak, hickory, and maple boards were used. Then came wood covered with linoleum; shortly before World War II, decorative laminated plastics were introduced to this market.

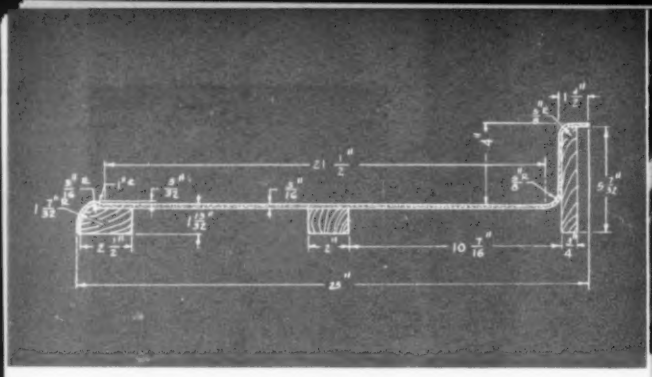
In general, these plastics tops consist of a horizontal surface and a backsplash, and are made by gluing decorative laminates to precut, prefitted pieces of plywood. The joint between backsplash and horizontal surface is filled with a cove molding. Also, to cover the edge of the plywood, a cap molding is used on the top of the backsplash and an edge molding on the front. These moldings are chrome plated or made of stainless steel or aluminum.

It has been the desire of many industrial designers to eliminate this "gingerbread" of chrome or stainless and to eliminate sharp edges and corners. With the increasing emphasis on the modern kitchen, a trend has been developing toward smoother lines and "water fall" curves—very noticeable in major appliances.

One-Piece Molding

With this trend in mind and with the desire to eliminate the collection of dirt and waste at the edges of the molding and in cracks, the idea of forming or molding a complete kitchen work surface in one

* Application Engineer, General Electric Co., Chemical Div., Coshocton, Ohio.



Cross section of counter top, giving the dimensions of the laminate piece as well as sizes and positioning of the batten strips

All illustrations both pages courtesy General Electric Co., Chemical Div.

Smooth plastic surface of laminated top is easily wiped clean. Molded one-piece design eliminates need for metal or other trim

plastic piece was investigated by General Electric. The problem was approached from the standpoint of manufacturing facilities and, in order to arrive at the best design for a top made of high pressure laminates, experts in the field of kitchen design were consulted.

General Electric's Home Bureau and the Appearance Design Section of the Major Appliance Div. gave outstanding support to the project and provided many helpful suggestions. Through their model work and knowledge of appliance trends, a design was reached which provided pleasing curves, a dripless front edge, and dirt-free corners unencumbered by stainless steel or chrome trim.

Fits 85 Percent

Through a study of a large number of sink cabinets being manufactured and of the profiles of their features, dimensions were established for the contours of a work surface now known as the G-E Textolite[1] Monotop counter. With the aid of many statistics drawn from kitchens planned by the Home Bureau, length was established which in multiples or in single units would fill requirements of about 85% of new kitchens.

With shape and dimensions determined, plaster models were made, wooden mock-ups were prepared, and decorative laminate was cemented in place to give the appearance of the finished part. Next, various thicknesses of laminated plastics were studied. A careful cost analysis of $\frac{1}{16}$ in. Textolite on plywood vs. $\frac{1}{8}$ in. or $\frac{3}{16}$ in. material with no plywood backing was made. With these preliminary studies, $\frac{3}{16}$ in. Textolite as a structural part with wooden batten strips placed in three positions was found to give adequate support as well as proper positioning on kitchen cabinets. Since the $\frac{3}{16}$ in. Textolite serves as a structural member, no plywood backing is necessary.

The melamine surfaced laminate used on this job is one of the most durable products that can be manufactured. It meets, and in most cases exceeds, the recommendations made by N.E.M.A. for decorative laminated materials. There is very little in normal everyday kitchen usage that will so much as dim the beauty of the G-E Textolite Monotop.

Molding Cycle Determined

While design was being established, technical problems encountered in high-pressure laminating such a molded product were studied. In order to determine molding problems before the mold itself was on hand, a prototype molding was made using a fairly simple angle mold in which both inside and outside radii were the same as those wanted in the Monotop. Studies on this mold gave the data needed to determine cycle and physical properties of the final molded part. After the cycle and build-up were established, the design of the mold was undertaken.

G-E Textolite Monotop counters are being distributed through the existing nation-wide organization already handling decorative Textolite material in standard flat sheets. These distributors will maintain warehouse stocks of the Monotop to serve fabricators and manufacturers who will make up kitchen counters and work surfaces to consumers' individual requirements.

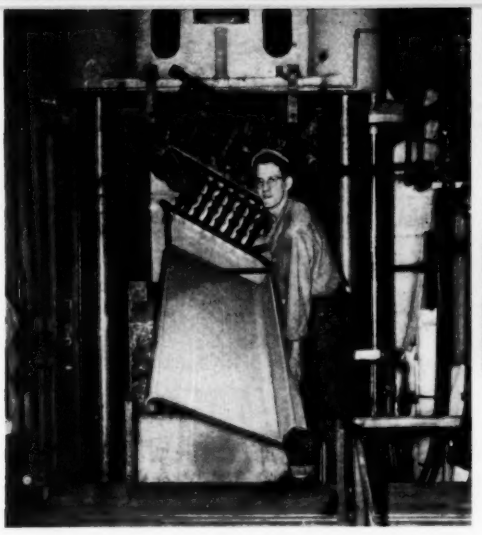
Fabricating the Top

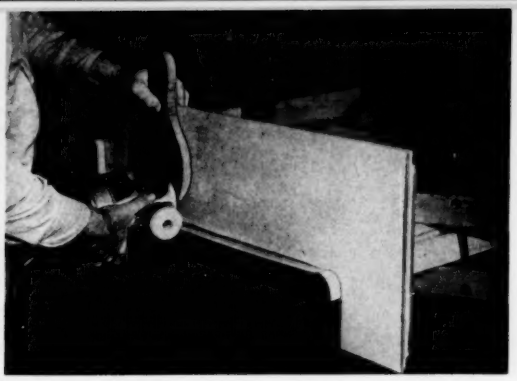
Since the Monotop surface is sold in 6-ft. lengths, it is necessary to fabricate shorter or longer tops. In this work, the back of the Monotop first has to be sanded so that the batten strips can be glued to it. The batten strips can be either poplar, pine, or plywood. Since almost every kitchen has a corner section, fabrication of corners can be made by mitering two pieces of Monotop. Also, a butt joint is necessary for making a running length of more than six feet. It has been found most practical to make this butt joint at the sink bowl so that there is a minimum of edge length to be fitted together.

The molded backsplash and front edge necessitate laying out and working on the sink bowl opening from the back. The starting point for a 21½ in. rim is 1½ in. from the front edge and for a Hudee rim this dimension is 1¼ inches. An oscillating saw with high speed blade makes a satisfactory cut and a scroll blade in the saw assists in cutting the corners.

A tool which is almost a "must" in fabricating operations is a router

[1] Reg. U. S. Pat. Office.





Jig guides router with skerfing saw blade to make smooth, square butt joint on counter top that can be tightly fitted

Molded laminate counter top unit, 6 ft. long, is removed from press. Flash is trimmed before delivery of units to distributors

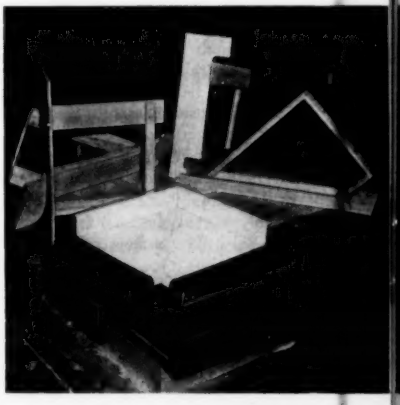
with a carbide tipped skerfing saw and a guide shoe attached. Fabricating jigs must also be made. One pair of jigs will aid in making a smooth, square cut on the Monotop, thus enabling this part to be butted against another similarly cut to produce a tight, barely discernible joint.

Another pair of jigs is used in fabricating a miter corner. First step is to make a rough band saw cut to take off the excess of the corner. Then the jig is clamped in place to guide the skerfing saw. In the photograph showing this jig in position, the band-saw cut has not been made. This makes it possible to show how the jig is clamped to the front lip and also to the backsplash. All of the jigs used are made so they are guided by or lined up against the backsplash surface.

After all cuts are made, the batten strips are glued to the sanded back. It has been found that by using the Monotop as a structural part, the batten strips can be applied easily and quickly with either electronic gluing or clamp gluing. The corner section is held together by running the front batten strip across the flat surface of the adjoining corner section. A butt joint is fastened together in the same manner. Two or three batten strips can overlap the seam and be glued into place. The seam is then backed up with short pieces of batten strip so that it will not sag and give under any pressure that might be applied to the top.

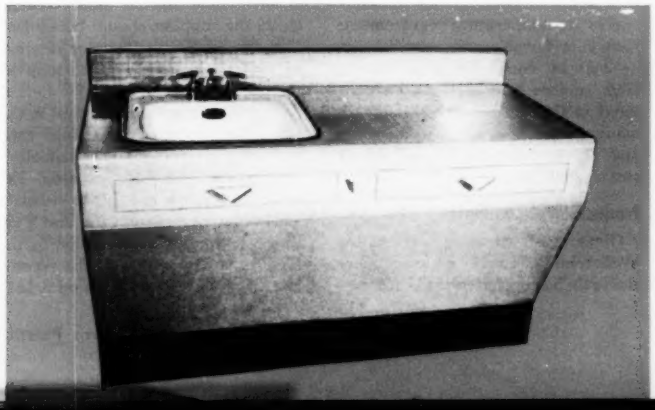
To complete a Monotop installation, end caps of flat Textolite can be glued to the ends, backed up with short pieces of the batten strip. These rectangular pieces are glued to the face of the end and then cut down with a router using a straight bit or a beveled cutter. In most cases, cut-off material can be used for these caps.

G-E Textolite Monotops are now being produced in the company's new cross-current design in red, blue, green, yellow, and gray.



Jigs are used in fabricating of finished mitered corner with squared edges

Miter jig is clamped to backsplash and front lip; in actual practice, excess at corner is first removed by band sawing



Seamless melamine-surfaced laminate unit is used in modern bathroom vanity

Silicone-Glass for Low Pressure

SINCE late in World War II, when the requirements of electrical components for naval and aeronautical use began to include extremely high heat resistance, silicone resins have been used with glass cloth in high pressure laminates. Although the properties of the finished material were excellent, adaptability was limited, because only flat sheets, tubes, and rods could be made by high pressure methods, and extensive fabrication was required. Despite these limitations, use of high pressure silicone-glass laminates has increased remarkably. Their extraordinary combination of heat resistance, excellent electrical properties, and water resistance have made them widely acceptable.

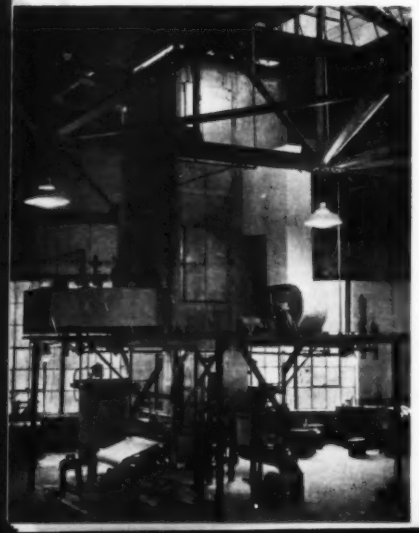
The desirability of a silicone resin that could be used with glass cloth for low pressure molding of large-area parts and complex shapes was obvious—if chemical, electrical, and thermal properties of the material could be maintained.

Only within the past few months, and only after almost five years of research, has a low pressure silicone laminating and molding resin been developed. This is the Dow Corning 2104 resin. According to laboratory reports to date, 2104 can be used to produce parts under low pressure with properties similar to those of high pressure laminates made with Dow Corning 2103.

Comparison of Various Types of Laminations

Fabric / *Resin*	*Cotton* / *Phenolic*	*Glass cloth* / *Melamine*	*ESS 261 Fiberglas* / *DC 2103*	*Fiberglas 181–112* / *DC 2104*
Flexural strength, p.s.i.				
⅛ in. panel, flatwise	18,000	48,500	22,000	25,000–35,000
Tensile strength, p.s.i.	9,000	30,000	15,000	35,000–45,000
Bonding strength, lb.				
½ inch panel	1,600	1,900	1,250	1,000
Water absorption, 24 hrs. %				
⅛ in. panel	1.25	1.45	0.21	0.5–1.0
Dielectric strength				
⅛ in. panel, volts/mil	200	260	250	up to 400
Power factor, (D-24/25) %				
100 mc.	—	—	0.97	0.32
ASTM arc resistance, sec.	10	190	300	>350

Vertical coating tower which is used for the low pressure silicone treating



The new resin, investigation of which has been in progress at Dow Corning under the auspices of the Materials Laboratory Research Div., Wright Air Development Center, is suited for the production of laminates and laminate moldings at pressures of 30 p.s.i. or less, and enough evidence has been collected to indicate that the silicone resins may now be considered a permanent addition to low pressure reinforced plastics.

As is indicated, one of the large potential uses of plastics laminates is in the aircraft field. However, until recent years, their use was restricted to non-structural parts. Their success in these applications has resulted in the development of more and more semi-structural and structural parts, with a marked increase in the use of low pressure materials. In the early stages of this work, lack of heat resistance in laminates was of little importance. Now, with the advent of supersonic aircraft, guided missiles, and so on, temperature requirements have gone far above those which can be met by conventional laminates. High surface temperatures encountered in this work make this one of many fields in which heat resistant low pressure laminates can do an outstanding job.

Production of Laminates

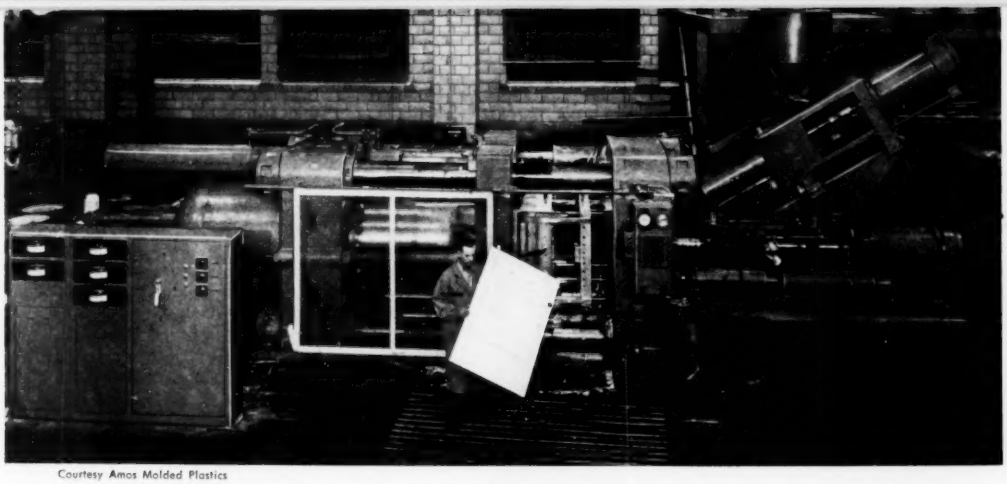
Glass cloth treating or coating work with 2104 resin on a commercial scale has been done at U.S. Polymeric Chemicals, Inc., Stamford, Conn. Laminates can be produced with the silicone resin from any glass fabric, although certain styles are preferred because of strength characteristics and ease of handling and molding. The more open-weave cloths require special care and handling in laminating.

Different styles of glass cloth and different coating techniques are required for different types of molding. High resin flow is needed for bag molding at approximately 14 p.s.i. For matched metal molding, the resin flow can be adjusted for any desired molding pressure.

Test results to date show that heat cleaning is the most satisfactory method of glass cloth surface preparation. Designations include Owens-Corning Fiberglas (112) and Glass Fibers, Inc. (V-12). Other finishes have been used, but they may have disadvantages, and the chromium content of some could possibly interfere with catalyzation. Even in the use of heat cleaned cloth, the supplier should be advised that the job is specified for silicone, so that no organic residue may be left on the cloth.

Type and amount of catalyst in the resin is even more important than the finish in producing a satisfactory impregnated cloth for molding. The resin itself has a low initial viscosity at laminating temperature, and a gel time which may be controlled by the amount of catalyst used. The recom-

(*Continued on p. 181*)



Courtesy Amos Molded Plastics

Injection molded refrigerator door liner is produced in 300-oz. Watson-Stillman press having a clamping pressure of 1500 tons. Supplementary pre-plasticizing cylinder at right has a rated capacity of 300 lb. of material per hr. The mold weighs 5½ tons

The Biggest Yet

DESCRIBED as the largest injection molded part ever made, a new one-piece refrigerator inner door liner having integral supports for shelves, egg compartments, and butter storage section marks an important new milestone in the refrigeration industry—and in injection molding. The liner is now being produced on a 24-hr. schedule for Admiral Corp. by Amos Molded Plastics, Edinburg, Ind.

Although statistics alone cannot convey the full significance of this plastics part, the bare figures are arresting. The liner, molded of Dow No. 475 styrene copolymer, measures 43 by 28 in. by approximately 6 in. deep and has a projected area of over 1200 square inches. Its weight is approximately 7.4 pounds. The mold, which weighs approximately 5½ tons, measures 54 by 38 by 22½ inches.

The part is produced on Amos' new 300-oz. Watson-Stillman injection machine, which has a 1500-ton clamp and a plasticizing capacity of more than 300 lb. of material per hour. This huge capacity results from the incorporation of a separate pre-plasticizer.

Admiral's new door liner is the first actual production part specifically designed for the new supersized injection machines now making their appearance in the plastics field. Up to the present time, these machines have had little opportunity to demonstrate their full production potential. A temporary shortage of styrene molding material, now overcome, was one factor which delayed the production of such big parts. Another factor was the element of die cost; molds designed to take full advantage of the production potential of such presses represent an investment in the $25,000 to $50,000 range. Before undertaking a tooling program of this magnitude, a manufacturer must be certain of the economic soundness of a given application.

Leadership in Big Parts

It is interesting to note that Admiral Corp., which for several years has pioneered new conceptions of size in thermosetting parts with record player, radio, and television cabinets weighing up to 40 lb., has now made a similar bid for leadership in the field of using thermoplastic materials.

The injection molded inner door liner is an application which has attracted the interest and study of plastics engineers ever since larger machines became available. However, in the early stages, it appeared that this application, at least as a plain liner, would be too expensive to compete with conventional liners. When door shelves and butter compartments were included in the cost estimates, however, the project took on a more favorable aspect. Such a design meant that the total number of parts involved could be reduced and that at the same time assembly time and labor costs could be pared accordingly.

After the Admiral design was complete, the company was so eager to get into production of the liner for its 1952 Dual-Temp Model 1292 that special arrangements were made to cut tooling time to a minimum. The set of dies for the new liner normally woud have required from six to seven months to produce, but tooling-up time was slashed to three and one-half months by changes in mold design which made it possible for a number of tool makers to work simultaneously on several different sections of the mold.

The new Amos-Admiral liner points the way to production possibilities for other king-size injection molded parts using today's big machines. These possibilities include entire refrigerator food storage compartment liners, kitchen cabinets, washing machine tubs, lighting fixtures, lavatories, water closet

Styrene liner combines convenience, attractiveness, and efficiency; rounded contours improve ease of cleaning

Photos above courtesy Admiral Corp.

Shelves molded as integral parts of liner give greater rigidity to piece

tanks, transparent enclosures for aircraft, and miscellaneous furniture items.

Advantages

Some of the outstanding advantages of the injection molded styrene refrigerator door liner include:

1) Conservation in the use of steel, titanium, cobalt, and other critical materials used for porcelain enameled steel parts.

2) The all-plastic liner, designed to incorporate many parts in the original molding which would normally have to be assembled, is more economical.

3) Greater acid resistance is obtained.

4) The plastic liner tends to reduce the over-all weight of the refrigerator.

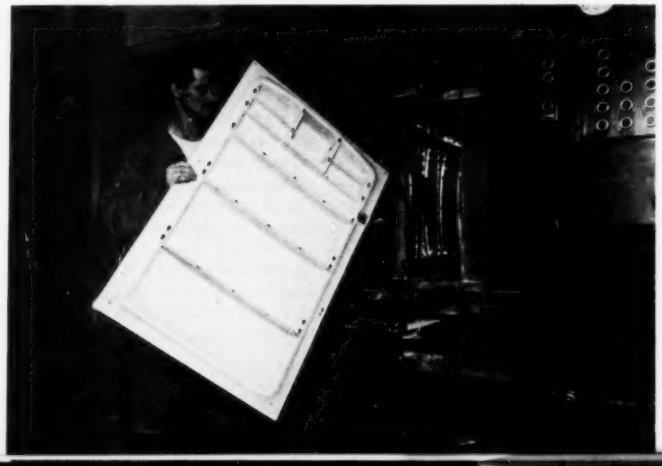
5) The plastic liner is more desirable due to the insulating qualities of plastic as compared to metal.

The Model 1292 refrigerator on which this big liner is used is a two-door type having a separate compartment with 2.2 cu. ft. of frozen food storage. The liner for this upper door follows the same construction, being injection molded of impact-resistant styrene and having an integral support for a single inner shelf. This liner, measuring 12 by 28 in., is produced by Erie Resistor Corp., Erie, Pa.

The use of injection molded styrene for these liners affords integral color ("glacier blue") that eliminates the need for any application of surface finish. The plastic material also provides excellent thermal insulation and will not absorb food odors; neither does it stain easily.

Contoured Design

Incorporation of the door shelves, which contribute much additional convenience to the refrigerator, called for a contoured design which is a far cry from the essentially flat type of inner door liner. In order to accommodate such features as the three shelves for bottled goods and dairy products and the four trays for holding a total of 16 eggs, the liner must have considerable depth. The butter conditioner compartment, which holds up to a lb. of butter in a clear styrene tray and cover, is the deepest section of the entire molding. The fact that the liner is molded with the door shelf bottoms, egg receptacles, and butter compartment as integral parts of the piece not only speeds up and simplifies the attachment of the shelf fronts and other accessory components, but also gives the entire part



Courtesy Amos Molded Plastics

Door liner, 43 by 28 in. and weighing 7.4 lb., is removed from the mold

great rigidity. The strength of the shelf bottoms is so great that they will bear the weight of a man. Concealed ribs and fillets on the back of the liner provide further rigidity.

More than 30 openings are molded into the liner to facilitate assembly. Included in this number are the cored bosses where attachment is made to the steel frame of the door; the "keyhole" slots through which the shelf fronts and butter and egg compartment front are attached to the liner; the large opening which accommodates the latch mechanism; and the openings near the front of the shelf bottoms which provide further attachment for the shelf fronts. There is one small opening at the back of the butter compartment to provide access for the butter conditioner control wires. Finally, there are two large side openings at the ends of the butter compartment. Into these openings snap the circular studs on the end flanges of the lift-up type butter compartment door. This part, molded of clear transparent styrene and spray painted on the back in two colors, is produced by Sinko Tool & Mfg. Co., Chicago, which also molds the clear styrene butter tray and cover.

Shelf Front Fastenings

The method used to fasten the shelf fronts to the liner provides a positive attachment which cannot loosen in service. Cored bosses at the ends of the fronts receive large headed thread-cutting screws. When these heads are inserted through the keyhole-shaped openings in the face of the liner and the front forced downward, both ends are drawn up tightly against the liner for secure fastening. At the same time, prongs on the lower side of the shelf fronts snap through slots near the fronts of the sills. The flexibility of the copolymer material permits the moldings to be snapped into position in a matter of seconds. The shelf fronts, which are equipped with clear styrene identifying plates, spray painted on the reverse side, are molded by Superior Plastics Div., Commonwealth Plastics, Inc., Chicago. Fronts for the egg receptacles and butter compartment, comprised of single moldings, are also secured to the liner by means of keyhole-shaped slots. They are produced by the same molder. Kent Plastics Corp., Evansville, Ind., molds and decorates the identifying plates for the shelves.

New Thinking Needed

Amos engineers point out that, in working with very large plastics parts, a change of thinking is necessary with reference to the matter of tooling. "Due to the size of molded parts," says J. C. Kazimier, chief engineer of Amos, "molds must be designed in such a way as to eliminate large component parts, since there are few tool shops with equipment large enough to produce, or the ability to harden, large pieces, without serious distortion."

The 300-oz. Watson-Stillman machine used by Amos in producing this part weighs 76 tons and can accommodate molds as large as 4 by 6 ft. in size. It is 31 ft. long and has a pumping assembly which adds another 11 ft. to its length. Zone temperature control is used on mold.

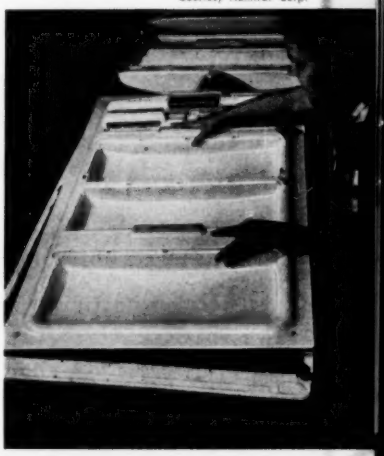
Many Plastics Parts

Although this part, eclipsing all previous production moldings in the injection field, is a highlight of interest in Admiral's new Model 1292 refrigerator, the appliance also contains a number of other plastics parts which give it increased performance and appearance.

Among these parts are the exterior trim on the door and on the door shelf front of the frost chest, produced by Kent Plastics; the styrene breaker frames, produced by Standard Products Corp., St. Clair, Mich., and Cambridge Molded Plastics, Cambridge, Ohio, and the large crisper pans, also produced by Standard Products. Crisper shelves for this model are supplied by the following firms: Plastic Molded Products, Chicago; Cruver Mfg. Co., Chicago; Injection Plastics Corp., Chicago; Santay Corp., Chicago; Minnesota Plastics Corp., St. Paul; Wolverine Plastics, Inc., Milan, Mich.; and Ideal Plastics Co., Hollis, N. Y.

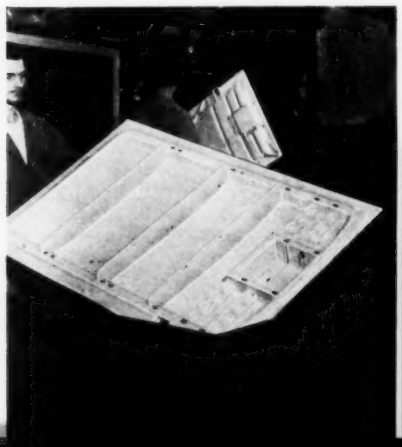
Liner is attached to door by screws engaging cored bosses at each corner

Courtesy Admiral Corp.



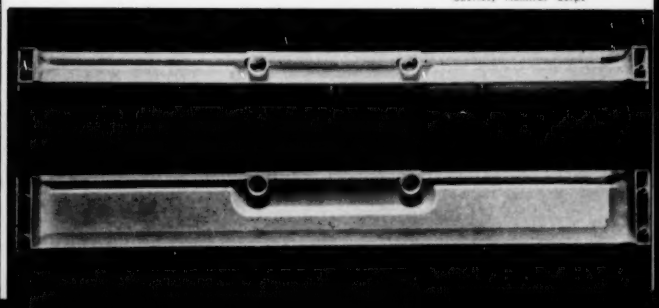
Courtesy Amos Molded Plastics

Liner, ribbed and filleted for added strength, is removed from press (rear), packed in corrugated boxes for shipment to assembly plant

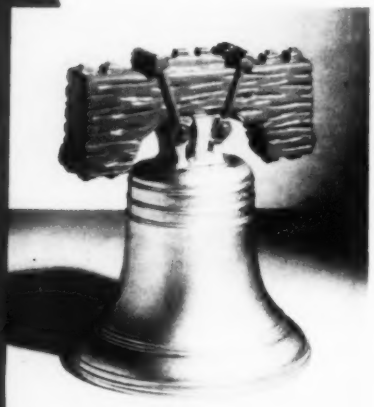


Bosses (outer ends) at rear of shelves receive screws that attach shelves to liner through slots; center openings are for decorative plates

Courtesy Admiral Corp.



Bank molded of Lustrex styrene is an au... reproduction of the Liberty Bell. It is ...olded of metallic colored material for greater ...ism of appearance. Bank has extra large ...city, opens from below. Made by Art Plas... Co., 511 Lancaster St., Leominster, Mass.



Grease-proof vinyl film laminated to a thin cushion of foam rubber is used to make fender cover which protects finish of car from damage while it is being repaired or serviced. The vinyl protects the car from grease, oils, acids, or dirt. The cushioning makes it possible to place heavy tools on the fender without damage. Goodyear Tire & Rubber Co. makes the vinyl and the Airfoam. The covers are marketed in two sizes, 27 by 36 in. and 33 by 54 in., by Industrial Covers Co., Akron, Ohio.

PLASTICS

... tape rule has colorful, light-weight, ...ble case molded of Hercocel E ethyl cel-...se. The case of the compact 6-ft. rule ...virtually unbreakable and will not rust ... corrode. The rule, called the Featherlite, ... made by Stanley Tools, New Britain, Conn.

Rings molded of cellulose acetate have action toys or games with movable parts built into them. Basketball and football games, housed in clear dome, can be played by operating metal spring which protrudes from dome. Cowboy ring has removable hat with compass under it. Fireman hat has siren under it. Another model has two hinged lenses which open to form a microscope. All the rings can easily be adjusted to any finger size. The rings are manufactured by The Robbins Co., Attleboro, Mass.

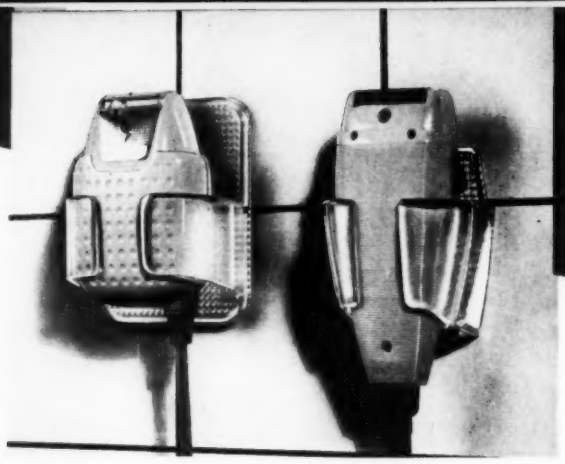
Funnel molded of styrene has rectangular mouth instead of round one. Thus the funnel does not roll when it is placed on a flat surface, it can easily be stored in a shallow drawer, and liquids do not swirl in it. The 5-in. long funnel is only $1\frac{5}{8}$ in. wide. It is made of red, green, or ivory material by Bridges Plastic Products, 1201 E. 63 St., Los Angeles 1, Calif.

...ic, already being used widely on outdoor furn... ...ith aluminum frames, is now also being used on wrou... iron furniture. Armchair 23 in. wide has sling seat and back m... of red, blue, and ivory bayou plaid Lumite. Same easy-to-c... material is also used in an armless side chair. Both chairs are ... by Pacific Iron Products, 1150 E. Peco Blvd., Los Angeles,

Molded acrylic house numbers are efficient reflectors because they have hundreds of tiny lenses molded-in. The principle is the same as that used in the highway reflecting signs made by the same manufacturer. The house numbers are $3\frac{1}{2}$ in. high and have molded-in holes for brads. Made by Reflexite Corp., 114 Manhattan St., Stamford, Conn.

Combination brush and soap dispenser can be used to eli... the dishpan when washing dishes, or for cleaning rugs, upho... or woodwork. Water and detergent are placed in 6-oz. blow mo... polyethylene bottle and the mixture is dispensed as needed thro... a round nylon-bristled brush. Suds escape only when bottle... Bottle is molded by Elmer E. Mills Corp., 2930 N. Ashla... Ill. The dispenser is manufactured by An... Ravenswood Ave., Chicago 40, Ill.

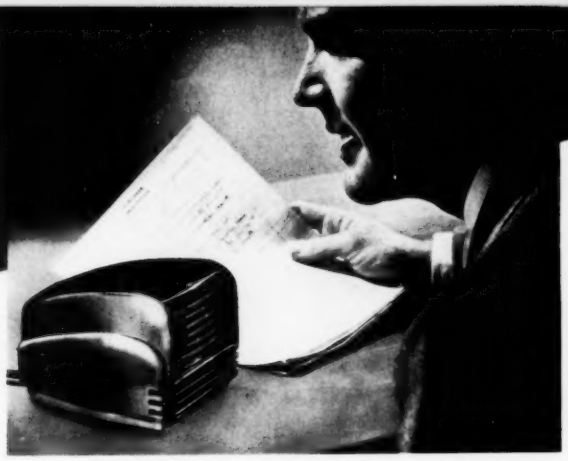
Pocket size electron… diagnosis by amplifying patie… 50 times. Unit, containing both micropho… eaker, has gray Tenite II cellulose acetate butyr… housing and weighs only 9 oz. Device, which … ches on doctor's regular binaurals, is made by …tronic Stethoscope Corp., 1316 Sherman Ave., …ston, Ill. Housing is molded by Keolyn Plas… …nc., 2731 N. Pulaski Road, Chicago 39, Ill.



Wall holders for Schick Electric Shaver are molded of transparent Lucite. Design is molded-in to back of holders so that front surfaces are smooth and easy to clean. Two different holders to fit any of the current models of the Schick Shaver are molded by Shaw Insulator Co., 160 Coit St., Irvington, N. J., for Schick, Inc., Stamford, Conn.

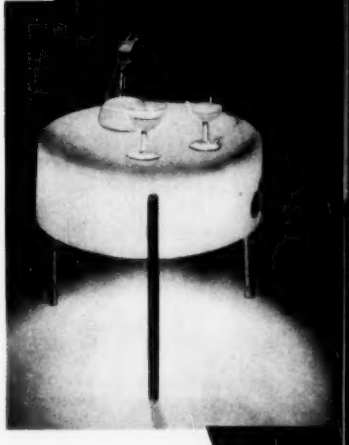
…nch-square tile panels with striated surface …olded of Lustrex styrene. The tiles, called …-Blok Texture Tiles, combine the textured ef… of special wood panels with the washability … integral color of plastics. Made by Plastic …gineering, Inc., 8506 Lake Ave., Cleveland …

File molded of Lustrex styrene keeps 2 in. square transparencies in order, ejects them one at a time as a tab is pressed. Slides thus can be removed easily, even in a dark room. After each slide has been shown, it is replaced through a special slot. The slide file, called E-Z-Ject, is molded by International Plastic Industries, 950 N. Cahuanga, Hollywood, Calif., for Westerlind Products, 1000 E. Walnut St., Pasadena, Calif.



...rushes, tumble...
...throom wall and swings sh...
...in use, leaving a smooth panel, flu...
with the wall. The unit thus presents a ...
appearance and protects contents from ...
Molded of Plaskon urea by Wilcox Plastic...
Los Angeles, for Hall-Mack Co., Los A...

Desk microphone for Dictaphone has gray housing molded of Tenite I cellulose acetate. The light-weight, chip-proof, streamlined housing is made of two pieces—a bottom plate and a main shell with molded-in grillwork. The pieces are molded by Watertown Mfg. Co., Watertown, Conn., for Dictaphone Corp., 420 Lexington Ave., New York 17, N. Y.



Clay flower pots can be dressed up with colorful "slip covers" made of 20-gage Vinylite sheeting. They are unaffected by the moisture from spillovers and can easily be wiped clean of mud or dirt. The jackets are available in various styles, some of which slip over the pot, some of which have snap fasteners. They are made in a number of colors and textures to fit standard 3, 3½, 4, and 4½-in. pots. Seams are heat sealed. Made by Anglers Products Co., 45-22 162 St., Flushing 58, N. Y.

Functions of a table and a ...
combined in Lam Lite-Table...
of Laminac polyester resin re...
with Fiberglas. Table casts so...
from below, can serve as night...
Surface is stain-resistant. Mad...
Lam Workshop, Inc., Brookline, M...

Courtesy Camfield Mfg. Co.

Left: Part of a day's production run of Army sleds molded of glass mat impregnated with polyester resin. Below: One of the sleds, complete with duck cover, tie-down rings and ropes, and pull rings and rope. Sled shown is slightly over 7 ft. long

Official U. S. Army photo

Army Sleds for the Arctic

by CARL E. HOLMES†

TWO sizes of Arctic sleds, molded of reinforced plastics, have been developed and standardized by the Army Quartermaster Corps for use in transporting small supply loads over ice and snow. These two sleds, one of 100 lb. capacity and approximately 4 ft. long by 2 ft. wide, and another of 200 lb. capacity and slightly over 7 ft. long by 2 ft. wide, weigh only 24 lb. and 36 lb. respectively. These two sizes replace a 400-lb. capacity wood sled which was unwieldy and required several men to haul it.

The new sleds are made of glass mat impregnated with polyester resin; they have a permanent white surface which aids in camouflage and which is produced by the use of a special compound which also reduces the effects of abrasion. Three phenolic-impregnated cotton duck runners give good tracking characteristics. Pulling rings and tie-down rope rings for securing cargo complete the sleds.

The larger sleds are being molded by Camfield Mfg. Co., Grand Haven, Mich. They are being successfully produced from low cost male and female molds which are themselves made of fibrous glass cloth impregnated with a compound consisting of a polyester resin, a catalyst, and an accelerator. Impregnation is done by the Marco vacuum method.

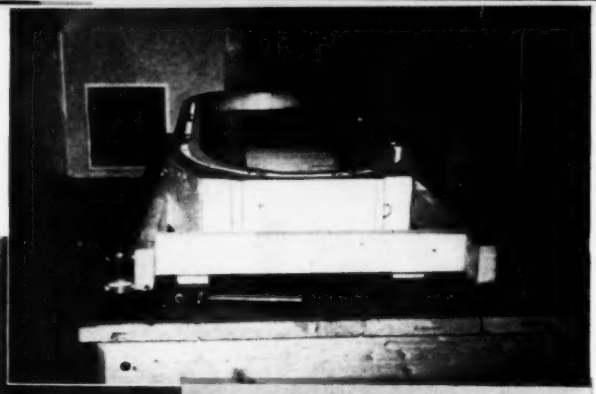
In the production of these molds, an accurate model was first made in wood. This wooden model was so designed that it could be used to produce a male mold with a deep skirt around its entire periphery. The depth of this skirt was determined by the fact that it was to act as a reservoir which would hold the required amount of impregnating resin. Size of the model was such as to allow for approximately 0.006 in. per in. of shrinkage. After the model was carefully sanded smooth, it was polished with a fine grade of steel wool. Care was taken in making the model to be sure that it was free from crevices into which the impregnating resins could flow.

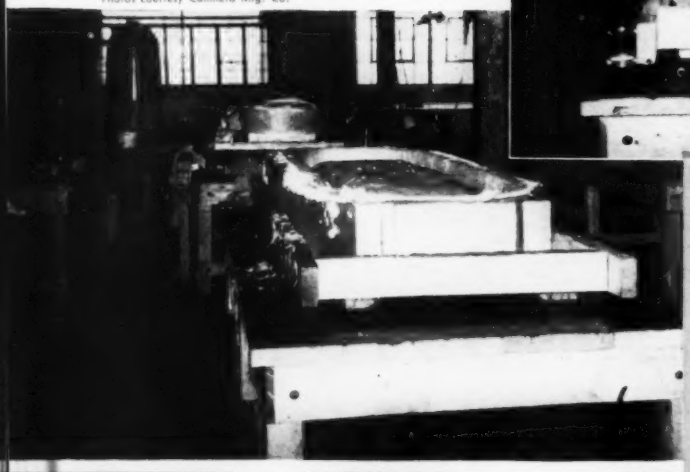
Separating Agent Sprayed

Two coats of paste wax polish were then applied to the wood, with time enough allowed between coats for complete drying. Next, a coating of a separating agent was sprayed over the entire surface, including the skirt. When this separating coat had hardened tack-free, a layer of polyester resin approximately $^{63}/_{64}$ to $^{1}/_{16}$ in. thick was sprayed on. Since each coat of resin would build up to only about 0.010 in. thick, several coats were necessary. Sufficient

* Reg. U.S. Pat. Office.
† Manager, Reinforced Plastics Div., Camfield Mfg. Co., Grand Haven, Mich.

Photos courtesy Camfield Mfg. Co.



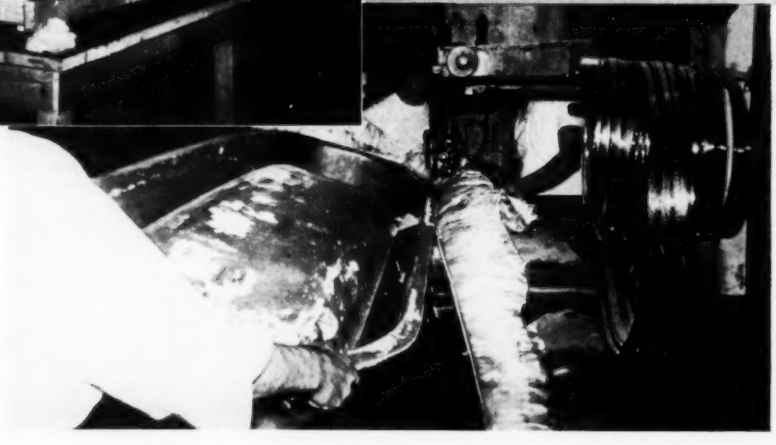


Above: Wooden model on which the male mold for sleds is produced. This model is accurately made and is given a final smooth polish with fine steel wool. It is then waxed and sprayed with a separating agent before layer of resin is applied

Upper left: After initial resin layer has been built up, multiple layers of glass cloth are put into place, crossing each other at a predetermined angle. Each layer is resin impregnated

Lower left: After curing, mold is removed from wooden model. Exothermic heat generated during cure is permitted to dissipate before this step

Below: Flash is removed from mold by band-sawing. Note trough for resin formed as part of mold



quantities of catalyst and accelerator were added to the polyester so that each coat hardened in about ten minutes. This initial resin coating was used to keep the glass fibers away from the mold surface, and, at the same time, provide a sufficient thickness of resin for sanding off any irregularities without reaching the glass area.

Approximately 15 layers of fibrous glass cloth were then laid into the model, each layer crossing the other at about a 30° angle. Each layer was thoroughly impregnated with polyester resin, catalyzed to set up in about 4 hours. Large paint brushes were used to apply the impregnating resin to the cloth, but something more than the usual painting motion had to be used to be sure of good impregnation. The resin was literally pounded into the interstices of the cloth with the ends of the brush bristles. This pounding action not only assured perfect impregnation, but it eliminated air pockets between layers.

After the mold hardened, the heat generated by exothermic action inherent in this catalytic type of curing was allowed to completely dissipate before removal from the model. This minimizes possible after-shrinkage and helps to assure dimensional stability. After the mold was removed from the model, flash was band-sawed off.

Matrix Built

With the male mold completed, it was then necessary to lay up a matrix which was the exact shape and thickness of the finished sled, since the female mold was to be produced over it. To produce this matrix, a separating coat, over which was applied a resin coat approximately 1/16-in. thick, was provided by the same methods used when preparing the surface of the original wooden model. Glass cloth was then laid-up over the coated mold, care being taken that the glass cloth was accurately pre-cut to the proper pattern to drape quickly and smoothly.

Impregnation of the cloth was accomplished one ply at a time, and sufficient cloth was laid up so that the thickness would be equal to that desired in the finished sled. After the resin had hardened and cured, the outer surface of the matrix was sanded smooth and two coats of wax were applied. Again, a separating agent was applied over the wax.

Production of the female mold from the matrix followed the same procedure as the production of the male mold, the only difference being that the resin coatings and lay-up were applied on the surface of the matrix just described instead of on the wooden model. Of course, the original wooden model and the polyester Fiberglas matrix can be used in making as many pairs of molds as production rate requires.

First step in the actual production of sleds required the mounting of the male mold in a wooden framework. This frame served not only to support the mold in a horizontal position, but also as an anchorage for various clamping arrangements to hold the female in position during the molding operation. The male mold, which serves to mold the top surface of the sled, was then waxed, a separating agent applied, and several coats of catalyzed, pigmented polyester resin were sprayed on. The female mold was then prepared in the same manner, except that the final spray coats of polyester resin were mixed with a filler as well as a pigment. This approximately 0.020-in. thick coating of resin and filler was specifically compounded to be highly abrasion resistant, since it was to be the bottom surface of the sled.

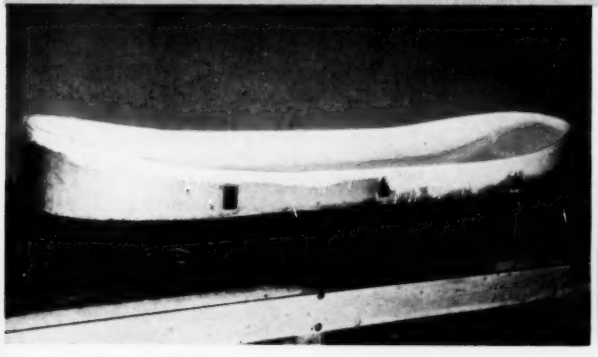
Sled Lay-Up

After the resin coatings on the male and female molds hardened, the required number of layers of Fiberglas mat to make up the sled thickness were laid in position over the male mold. The female mold was then positioned over the Fiberglas mat layer, and clamped securely.

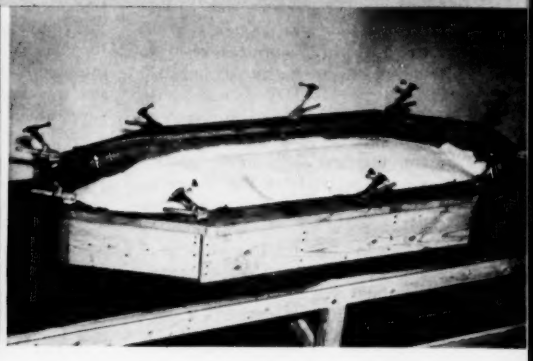
Since the impregnation of the mat was to be accomplished by the Marco method, the female mold had previously had a hole made through the center of it, to which was attached a vacuum port. This port was connected to a glass tube, which in turn was connected by rubber tubing to a glass flask, and thence to a vacuum pump. An amount of catalyzed resin sufficient to impregnate the entire layer of Fiberglas mat was then poured into the trough formed by the skirt on the male mold and a vacuum of about 15 in. of mercury was applied to the vacuum port.

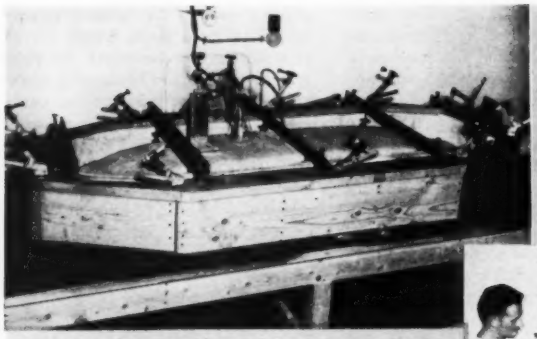
Because of the vacuum, the resin

Female mold, ready for molding operation, with wax, separating layer, and sled's outer coat of filled and pigmented polyester resin already applied

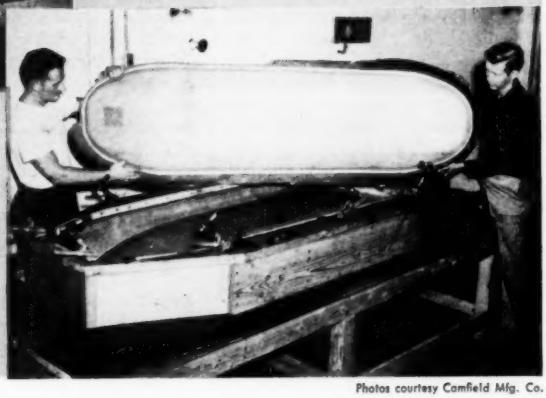


Male mold in wooden frame equipped with clamping arrangements. Fibrous glass mat is in place over sprayed-on layer of resin





Below: Removing molded sled from the male mold after cure. Major finishing operation consists simply of removal of excess flash, using a diamond dust impregnated disk



Above: Mold set-up during vacuum impregnation of the glass cloth. Note vacuum port, in center of female mold, to which glass tube is connected. When impregnation is complete, a solid column of resin appears in this tube

Photos courtesy Camfield Mfg. Co.

was slowly pulled from the trough into the voids of the glass mat layer, being sucked uniformly through the edges of the glass mat around the entire periphery of the lay-up. As the mold became nearly full of resin, bubbles of resin began to appear in the glass tube attached to the vacuum port. When the mold was entirely full and all air bubbles had been withdrawn by the vacuum, a solid column of resin appeared in the glass tube. At this point, a clamp was placed on the rubber hose, thereby trapping the vacuum in the mold during the approximately 40-min. gel and cure time.

Because this 8-ft. sled is domed lengthwise (4 in. from one end to the center), it was necessary to fill the trough with sufficient resin so that, when the entire lay-up had been impregnated, there was somewhat over 4 in. of resin depth at either end. Because of this requirement, the first sleds made by this company necessitated the use of an extra 17 to 18 lb. of resin in addition to that required for impregnating the lay-up. This was the amount of resin left in the trough after impregnation, and was a complete loss.

To eliminate this waste, V. C. McCall, director of research and development, Reinforced Plastics Div., Camfield Mfg. Co., devised a unique procedure. He redesigned the resin feed system so that, instead of using an open trough, a $\frac{3}{8}$ in. square runner circled the entire periphery of the molds at the parting line. This runner was completely closed, with the exception of the inner portion facing the edges of the glass mat lay-up. Two tubes, one at each end of the mold, connected these runners to two containers or reservoirs, which were supported at a level high enough above the floor to furnish sufficient head to keep the runners full of resin. This impregnation method requires that a pre-determined quantity of resin be placed in each of the two containers. Then, after sufficient time has elapsed for the resin to flow into and completely fill the runners, the vacuum is pulled. This method saves about 15 lb. of resin per sled.

Finishing

After cure had been completed, and the sled removed from the molds, the major finishing operation involved removal of excess flash. To get a smooth and uniform surface, a 6-in. diameter disk approximately $\frac{1}{16}$ in. in thickness, with a diamond dust impregnated bronze ring bonded to its outer diameter, was used. The disk was driven by a flexible shaft grinder supplied with a guide to ride on the top of the gunwale to insure the proper depth of cut. A stream of water was used as a coolant. Mr. McCall states that longer cutting blade life was achieved by increasing the diameter of the disk supporting washer after each hour of cutting. These washers are used to mount and support the thin cutting disk used in this type of operation. Increasing the diameter of these disks from time to time permits the flexing of the cutting disk to occur in different locations. Tool life may thus be increased 4 times.

After the trimming operation, the sharp corners were removed with medium grade sandpaper. The hull was then placed in a jig where all the holes were drilled for attaching the laminated phenolic runners and the numerous rings which are used for the pull rope and for tying down a load on the sled.

These sleds are used by the Army in transporting supplies and ammunition, evacuating wounded, etc. on snow and ice. They have proved themselves, over a period of two years, to have sufficient strength to withstand usage in rough terrain.

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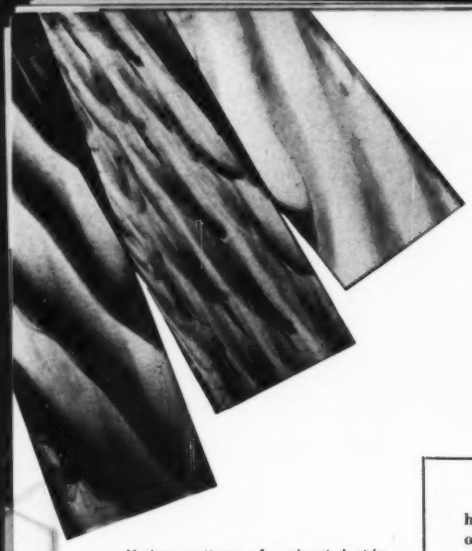
Continuous Extrusion of Variegated Strip



Various patterns of variegated strip can be produced by extrusion method

Tennessee Eastman Co., Div. of Eastman Kodak Co., Kingsport, Tenn., has a Tenite application laboratory for developing new general methods of using Tenite, as distinct from its laboratories devoted to finding new products or improving existing products. The methods developed and demonstrated to the trade have not been employed by Tennessee Eastman Co. in making products for sale. The demonstration methods or apparatus employed in connection with the demonstrations are presented to afford information. It is understood that those who are interested should make their own independent investigation of engineering safety or legal considerations before they proceed to employ the methods which are demonstrated.

PRODUCTION of variegated or tortoise-shell plastics strip by extrusion has been the subject of study and experimentation since 1949 in the application laboratories of the Tennessee Eastman Co., Kingsport, Tenn. Experiments were started using cellulose acetate (Tenite I) and also cellulose acetate butyrate (Tenite II).

In the early stages of this work, a number of mechanical mixtures were fed to a standard 2½-in. National Rubber Machinery Co. extruder. For example, one mixture consisted of 20 parts of amber Tenite I base with one part of dark brown filler in H-4 flow. This was fed to the extrusion machine, which was equipped with a die for producing a ⅛ by 1¼ in. wide strip. In another trial, 20 parts of clear Tenite II base were mixed with one part of brown filler, and extruded in strip form. In all these experiments, the filler blended completely with the base, producing an unsatisfactory figuration. As a result of these trials, it was concluded that when a mechanical mixture of base and filler was fed into an extruder, the filler would smear and darken the base too much.

Discarding the mechanical mixture idea, another approach was tried. In this, the filler was forced into the stream of base material by an air-activated ram mounted on the extrusion die. In this procedure, the dark filler met the base at a point 1½ in. ahead of the die opening; the filler pellets were not heated until they were forced into the softened base material in the die. By this means it was hoped that there would be little smearing of the filler with the base and that a more satisfactory figuration would result.

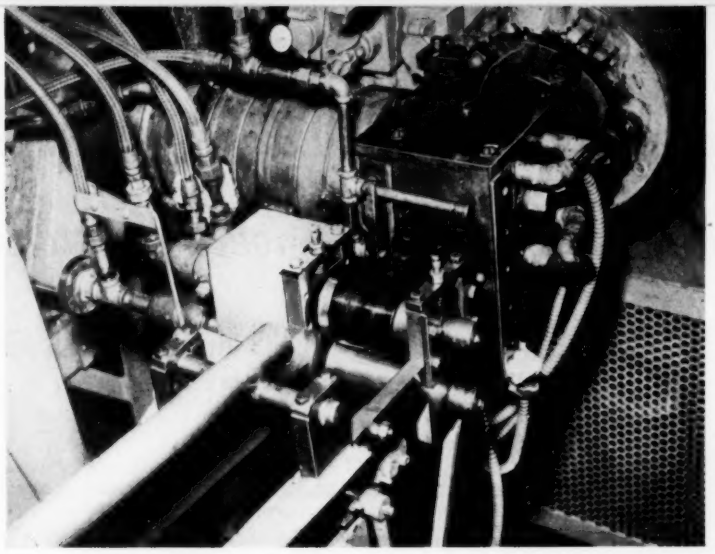
Hydraulic Jack Used

Upon starting the extruder, it was immediately found that, contrary to expectations, the pellets simply smeared on the surface of the strip and did not penetrate into the base. In an attempt to get penetration, a hydraulic jack replaced the air ram to get additional pressure on the filler material. This resulted in cold filler pellets being forced into the die opening and plugging it up. Enlarging the die opening and installing a baffle plate in which ⅛-in. holes had been drilled produced a series of stripes running parallel to the direction of the extrusion; again, the results were not satisfactory.

After abandonment of the methods just described, L. T. Murray, project engineer in charge of this development work, suggested a basic procedure which has subsequently proved successful. In this setup (see Sketch A), two extruders were to be used, one to supply the base material for the strip and another smaller extruder to feed softened filler into an opening in the die at right angles to the flow of the base material. The base was extruded through a strip die by a 2½-in. National Rubber Machinery extruder. The smaller extruder, a 2-in. National Rubber unit, was used to carry the softened filler material entirely across the width of this base strip. Encouraging results were obtained immediately. The configuration was of fair pattern and this pattern was controllable and could be duplicated. The distribution of the filler material, however, still left something to be desired when compared with commercial variegated sheet stock. The filler pattern was too regular and the inclination was for it to flow in uniform diagonal stripes across the width of the extruded strip.

Screw Tips

In attempts to improve the pattern, screw tips or adapters of several different designs were fastened to the delivery end of the screw of the extruder furnishing the filler. By variations of the pitch and slotting of the flights of these tips, vari-



Left: Close-up of die in two-extruder laboratory setup for producing variegated butyrate strip. Extruded strip passes between cooling rolls (in center) to a conveyor belt (at bottom)

Photos these two pages courtesy Tennessee Eastman Co.

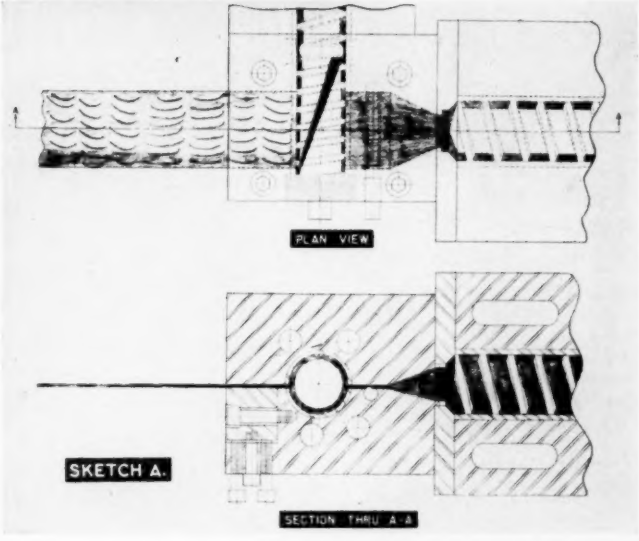
Below: Setup of two extruders (one 2-in. and the other 2½-in.) feeding into one die. The larger unit feeds the base material for variegated strip; smaller feeds filler

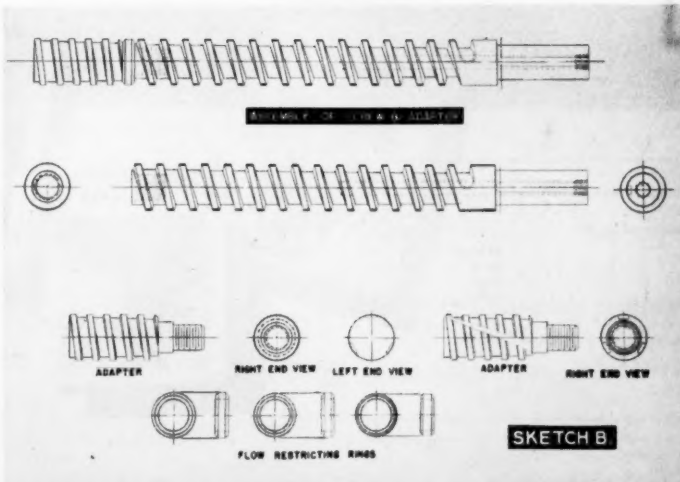
ous effects were obtained which made the extruded strip more nearly like the commercial product desired.

Experimental work was then centered on the design of the die. Additional variations in pattern were found possible by the installation of a flow restriction bar in the die so that the amount of base material furnished could be varied. It is probably true that greater changes in the pattern of the extrusion could have been achieved by controlling the amount of filler rather than of the base. However, because of the design of the die, it was only possible to insert the restriction in that portion of the die furnishing the flow of base material. With any given tip on the filler screw, the configuration remained the same; but by changing the proportions of filler to base, the darkness or lightness of the variegated strip could be changed.

Another successful method of controlling the proportions of filler and base involved varying the speeds of the screws in both extruders. But there is a limit to the amount of change which can be made in this manner and still obtain a uniform extrusion; the thickness of the strip is controlled to some extent by the speed of the extruder worms. However, this method can be employed within limitations for the altering of the color of the strip.

(*Continued on p. 124*)





Details of adapters and flow restricting rings which control variegation

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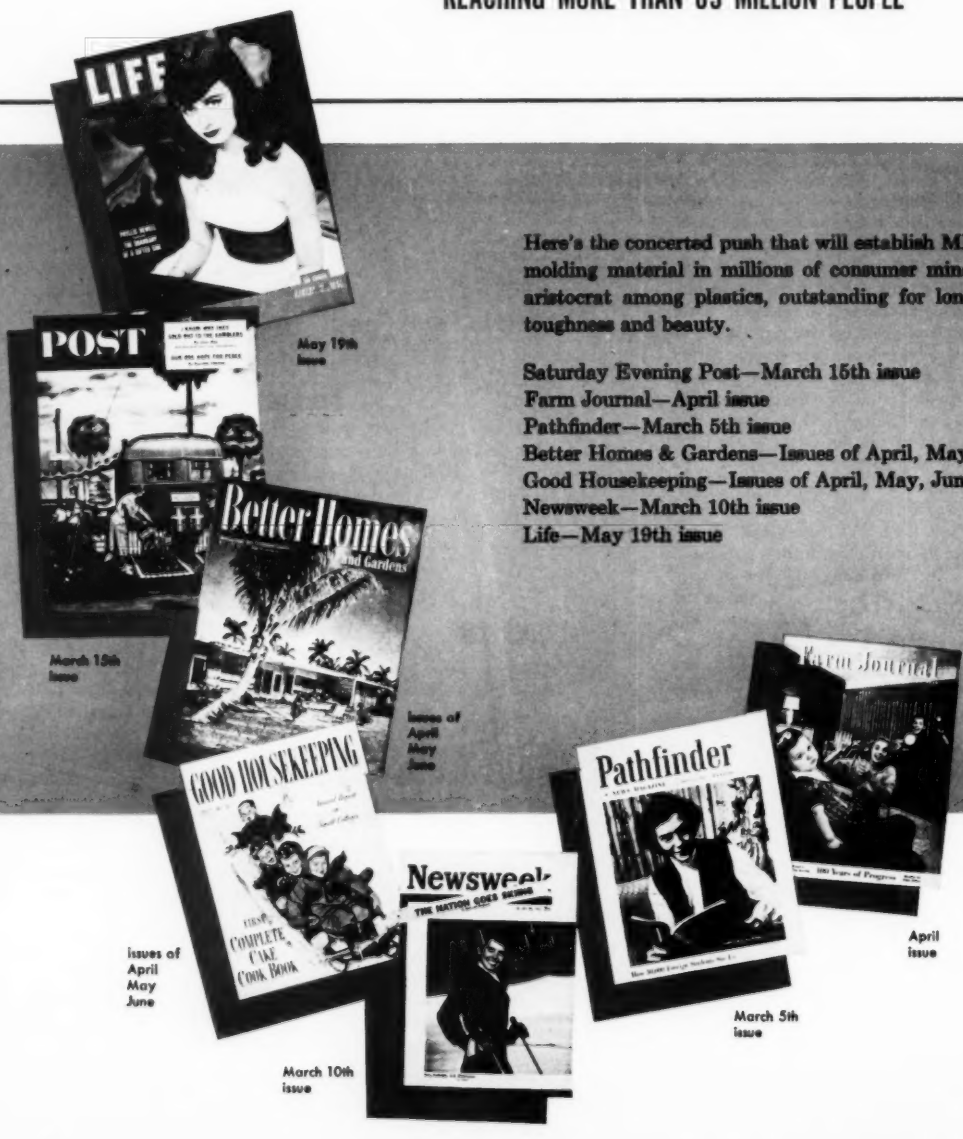

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These Special Formulations	Combining These Properties	Assure Top Performance In
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MELMAC 3020, 3024* (chopped-cotton-fabric-filled). A molding material ideal for uses requiring resistance to impact.	opaque and translucent colors odorless	Food trays and containers Mining machinery insulation Electric motor insulation Tableware
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MELMAC 1500-1502 (cellulose-filled). Made for industrial and electrical uses, with high arc resistance, excellent dielectric strength, low specific gravity and ease of molding.	inert arc resistant dielectric strength	Ignition parts (automotive) Circuit breakers Connector plug inserts Watt hour and meter blocks
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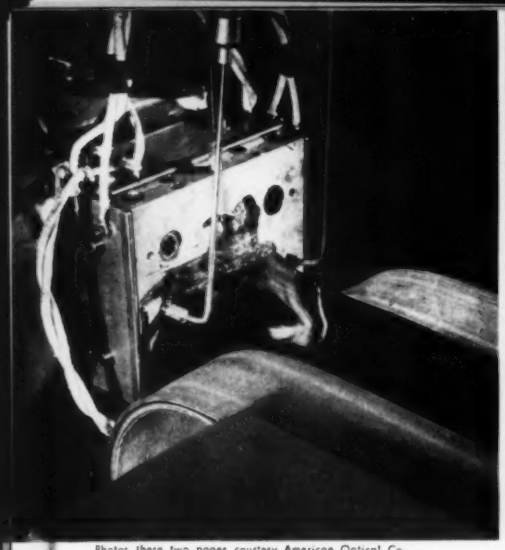
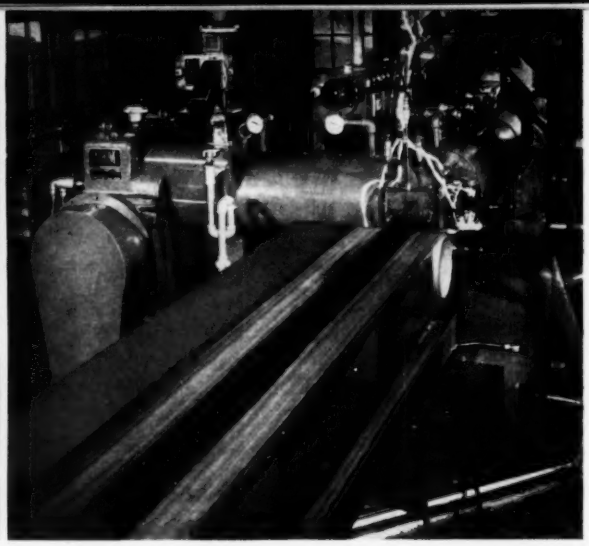




Photos these two pages courtesy American Optical Co.

Close-up of extrusion die in commercial production setup for extruding variegated strip for spectacle frames

Over-all view of commercial production setup using two extruders to feed two different colors of material. Pattern of resulting strip can be controlled

Still another method of changing the color of the extruded strip involved feeding a mixture of both base and filler to the filler extruder. This, however, merely resulted in a dilution of the filler in proportion to the base of the variegated strip, and was discarded as not feasible.

Filler Flow Restricted

As mentioned previously, it was considered desirable to restrict the flow of filler, but this was impossible to do in the die itself. It seemed feasible, however, to restrict the filler in the extruder itself by means of a spacer or restricting ring fitted on the screw of the filler extruder at the junction of the screw and the adapter tip. (See Sketch B.) Several different spacers were machined, designed so that their outside diameter fit within ⅛ in., 1/16 in. and 1/32 in. of the cylinder wall. Any one of these spacers would act as a torpedo to restrict the free flow of filler. This arrangement gave the best results insofar as color of the strip was concerned. It was only necessary to remove the tip, and assemble any one of the different size spacers on the worm, in order to obtain more or less restriction of the filler flow.

It is important to note that a definite change in the pattern of the strip could be obtained only through a mechanical change in the flights or the slotting of the tip of the screw feeding the filler. The over-all color of the base could be changed by controlling the amount of filler in proportion to the base; however, changing the speed of the screw feeding the filler would change the spacing of the filler pattern on the strip. Increasing the speed of the filler extruder, of course, gave smaller filler splotches closer together; conversely, when the speed was decreased, the splotches were larger and further apart.

Know-How Made Available

With these basic principles established, it was decided that the development had reached a point where it could be shown and explained to companies who might have an interest in the production of such variegated strip. Accordingly, a number of companies were invited to send representatives to the Tennessee Eastman laboratories to see the equipment in operation, and to obtain all the know-how available to date. American Optical Co., Southbridge, Mass., decided it could make good use of this extruded variegated strip stock in the manufacture of eye-glass frames. Accordingly, it placed an order with National Rubber Machinery Co. for a complete extruder and auxiliary equipment setup very similar to that used in experimental work in the Tennessee Eastman Co. laboratories. This equipment is now in production, and is furnishing stock which, after a number of precision fabricating operations, reaches the ultimate consumer in high-quality eye-glass frames.

The first step in making the so-called "front" of an eye-glass frame is to cut the wide strip into narrow widths. After preheating, the strips are blanked out by highly accurate polished dies. Lens grooves are then milled in the blanked-out front. In this operation, the speed of the sharp cutting tool must be carefully regulated in order to prevent chatter marks, which might affect the accuracy of frame size or mar the surface. The pieces are then tumble-finished, which includes in some cases a fast "cut-down" operation; usually, however, only burnishing and final high-luster tumbling finishing are required. Even though the finish at this point is very good, each finished frame is then hand polished to approach perfection.

Next step in the process is to mortise recesses in each front for the hinge which, after being pressed into the recess, is riveted firmly in place. "Out-setting the bridge" is accomplished by warming the front and then slowly bending the bridge to shape in mated dies under high pressure. This assures an accurate fit.

Slotted Strips

Each temple as produced at American Optical involves the use of two slotted strips of the extruded

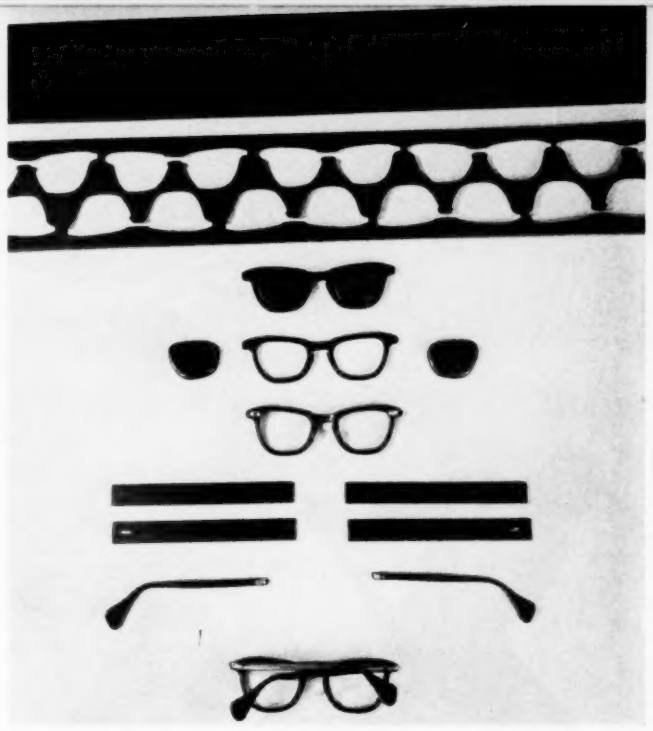
stock and one flexible wire. The wire is inserted in the slot of one strip, and the two strips are then firmly cemented together. After cementing, each temple is blanked to size and shape, and the edges are beveled. Finishing is done in the same manner as the fronts. The finished temples are then bent to an average head contour in a special die, after which the temples and fronts are brought together and mitered simultaneously to provide the stop for the hinge. Hand polishing completes the job.

Scrap Re-Use

American Optical Co. sees many advantages in the use of this extruded variegated material. One of the problems in the method just described for the manufacture of eye-glass frames is that a great deal of scrap accumulates. Since, however, the cellulose acetate butyrate now being used has been extruded only once, it has many possibilities for re-use, either in injection molding or extrusion. If the product to be made from the scrap can be mottled, the scrap can be granulated and used in an as-is condition. If the product is to be black, there is little if any coloring problem; also, there are other coloring possibilities for such scrap material.

Because of its large-scale operations, American Optical Co. is inventory conscious. Accordingly, their engineers point to a great advantage inherent in this extrusion method for the production of variegated stock: they are able to keep their inventory of material for fronts and temples to a minimum.

Eye-glass temples are made up of two strips of acetate with a wire insert



Stages in production of eye-glass frames. Top to bottom: Variegated strip, strip after blanking, blanked fronts, finished front, temple strips, temples, eye-glasses

Close-up of blanking operation in which highly polished dies are used. The acetate strip from which eye-glass fronts are blanked is preheated before this operation

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Protection of Cellulose Esters Against Breakdown by Heat and Light

by G. C. DeCROES AND J. W. TAMBLYN†

Some of the causes of the degradation occurring when cellulose ester plastic systems are exposed to excessive heat were investigated. It was found that the plasticizer is often the chief contributor toward breakdown. Most of the common plasticizers were found to be more easily oxidized than the cellulose ester itself, and the oxidation process induced breakdown of the chains. Antioxidants inhibited this type of breakdown whereas various metal soaps and titanium dioxide catalyzed it. In systems containing an oxidation-resistant plasticizer a similar breakdown could be produced by addition of a peroxide. A severe but non-oxidative type of breakdown was found to occur when the plasticizer contained ferric salts of strong acids. This thermal breakdown could be greatly reduced by the addition of a suitable chelating agent.

In the process of breakdown by ultra-violet light, oxygen also was observed to play an important part. The oxidizable plasticizer, dibutyl sebacate, was found to contribute to this type of breakdown but to a far lesser extent than to breakdown by heat. Ultra-violet breakdown inhibitors are discussed, and it is shown that antioxidants are useful only if combined with an additive which filters out the ultra-violet efficiently. In studies of weathering inhibitors, the thickness of the test piece is an important variable. Mechanisms by which ultra-violet breakdown inhibitors may be effective are briefly speculated on.

WHEN cellulose esters are overheated many changes occur, all of them unfortunately detrimental from the viewpoint of the user. Evans and McBurney (1)[1] have recently reviewed the earlier work on the stability of cellulose acetate toward heat and extended this with their own study of the oxygen absorption by the solid ester in granular form at 160° C. They found that oxidation proceeded at a conveniently slow rate at this temperature. Evidence was obtained of the release of the volatile products—acetic acid, carbon dioxide, carbon monoxide, and water. These decompositions were accompanied by progressive orange-yellow discoloration, increase in apparent acetyl content, and chain length breakdown in the residue. Measurements on the production of volatile matter, color, and chain breaking showed linear relationships between these quantities and the amount of oxygen absorbed, up to about one-fourth of an oxygen atom per anhydroglucose unit.

The breakdown of cellulose esters by natural or artificial weathering is, in many ways, a more complicated process than the thermal degradation. It is to be expected, however, that oxidation and other reactions occurring at elevated temperatures will still go on, even if more slowly, under outdoor conditions or in a weathering machine. The effects of the oxygen and water on the photodegradation of cellulose acetates have been investigated by Montonna and Winding (2), Lawton and Nason (3), and Heuser and Chamberlin (4). Some of the puzzling inconsistencies have been resolved by the interesting studies on cellulose by Launer and Wilson (5), who showed that these effects were markedly dependent on the wavelength of the ultra-violet light being used. It seems to be now generally agreed that, in the sunlight range, oxygen and water both assist in the breakdown processes.

Weathering produces marked changes in the appearance and physical properties of cellulose ester plastics. These effects have been described by Meyer and Gearhart (6). The photo-chemical aspects of degradation of cellulose acetate butyrate have been discussed by Tichenor (7).

In our work, the breakdown of cellulose esters themselves at elevated temperatures was studied briefly, but most of our experiments were made on plasticized systems. Inhibitors and catalysts for degradation in these systems were extensively investigated. Some of the variables involved in the weathering process were also studied. Possible mechanisms for the protection of cellulose ester plastics from ultra-violet breakdown by inhibitors are suggested. It was found that oxidizable plasticizers play a very important role in the breakdown by heat, but a less important role in weathering.

Since the investigation was primarily exploratory in nature, no

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* Reg. U.S. Pat. Office.
† Research Laboratory, Tennessee Eastman Co.
[1] Numbers in parentheses link to the references on p. 189.

purification treatments of the materials used were undertaken except in a few cases. In most of the experiments to be described, a regular production grade of powder-precipitated cellulose acetate butyrate containing 13% acetyl and 37% butyryl was used. Additives such as plasticizers, antioxidants, inhibitors, breakdown catalysts, and so on, were mostly the best grades of commercially available materials.

The nitrogen used in experiments run under an "inert" atmosphere was further purified before use. Gas from a tank containing 0.3% oxygen was led through a drying train and passed at 350° C. over fine copper oxide wire which had been reduced under hydrogen at 300° C. to bright copper. By this means the oxygen content of the nitrogen was reduced to 0.001% before the latter entered the reaction vessel.

Test Procedures

Thermal Breakdown—Degradation by heat was carried out in 125-ml. Erlenmeyer flasks shaken back and forth at 50 cy./min. through an arc of 60° in an oil bath. Except for some of the experiments with pure cellulose esters that were run at 180° C., the temperature of the bath was held at 150±1° C. The atmosphere above the cellulose ester system was confined by a gas burette and mercury reservoir kept manually adjusted to atmospheric pressure at frequent intervals throughout the run. When a plasticizer was used, 1 g. of the cellulose ester was mixed with 25 ml. of the plasticizer (or 25 g., if the latter was a solid). Other additives, such as antioxidants, if used, were added in amounts of 0.02 g., except where otherwise noted.

Natural Weathering—Outdoor exposures were made on the roof of the Research Laboratory at Kingsport, Tenn. Test strips of plastic, usually 2.5 by 0.5 by 0.050 in., cut from rolled and compression-molded sheets, were mounted facing south without backing at an angle with the horizontal of 36.5°, the latitude at Kingsport. All samples were washed with mild detergent and rinsed with distilled water once each month. The basic formulation used was 12 parts of dibutyl sebacate to 100 parts of cellulose acetate butyrate, which gives a plastic of medium-soft flow. If used, soluble additives such as ultra-violet inhibitors or antioxidants were usually held to 1 part, and pigments to 2 parts, unless specified otherwise. Some measurements were also made on sheets of thickness varying from 0.025 to 0.187 in., which had been exposed at Phoenix, Arizona, on conventional racks (6). These samples were obtained through the courtesy of the Cellulose Esters and Plastics Development Laboratory.

Accelerated Weathering—The Atlas Twin-Arc Weather-ometer, with carbon arcs enclosed by Pyrex globes, was used at 60° C. on a cycle consisting of 51 min. without water spray followed by 9 min. with water spray. An exposure of 50 to 150 hr., or even longer for some materials, was required in this machine to equal the breakdown obtained during one mid-summer month outdoors at Kingsport. The plastic test pieces were again usually 2.5 by 0.5 by 0.050 in. In some experiments, the Weather-ometer was modified by the addition of 8 Westinghouse 20-w. fluorescent sun lamps to raise the shorter ultra-violet output. The test samples thus received radiation more nearly like sunlight. These lamps were mounted vertically at a distance of about 2 in. from the sample drum. Factors correlating this test with outdoor exposures have not yet been determined.

Table I.—Oxidative and Thermal Degradation of Cellulose Acetate Butyrate*

Temp.	Atmosphere	Apparent acetyl	Color	Degradation
°C		%		% mol. wt.
Unexposed		34.7	White	0
150	N_2	36.6	Brown	64
150	O_2	37.2	Brown	81
180	N_2	37.2	Black	48
180	O_2	37.2	Black	90

* 24-hr. exposure.

Acid—The acid formed during degradation was titrated to a phenolphthalein end point with 0.1 *N* sodium hydroxide solution in 1:1 ethanol:acetone medium.

Peroxide—Peroxides were measured by an iodimetric procedure in 1:1 ethanol:acetone medium at a cellulose ester concentration of 0.23 g./100 ml. of solvent. The method of Kokatnur and Jelling (8) was modified to eliminate the 5-min. heating period. When the solution containing free iodine was heated, as required by the unmodified procedure, low peroxide values were obtained, probably because of reaction of the iodine with some of the degradation products. Our peroxide values may thus still be lower than the true values if certain relatively stable peroxides were formed during degradation. The nature of the peroxidic matter present was such that the peroxide values obtained did not change on standing at room temperature for 15 hours.

Apparent Acetyl—The procedure recommended by Malm, Genung, Williams, and Pile (9) was followed. These measurements were made in the Analytical Department of the Research Laboratory.

Viscosity—The procedure of Wagner and Russell (10) was used. Inherent viscosities (11) were calculated from measurements on solutions containing 0.23 g. of cellulose ester per 100 ml. of acetone. In the thermal experiments, in which excess plasticizer was used, the solution contained as much as 6% plasticizer. Appropriate blanks on the solvent were run in all such cases. When desired, number-average molecular weights were estimated from published viscosity-molecular weight relationships for cellulose acetate butyrate (12) and cellulose acetate (13).

Flexural Strength—This property was calculated for unweathered and weathered plastic samples from data obtained by the Tour-Marshall test for stiffness in flexure (A.S.T.M. D 747-43T).

Brittleness—Brittleness was defined to have developed in the plastic test strip when a break occurred at a bend angle of less than 90° in the Tour-Marshall test.

Breakdown by Heat

Our experiments on the breakdown of the solid unplasticized esters in powder or sheet form at 150° and 180° C., were in agreement with those of Evans and McBurney (1). However, we interpret our results to indicate that the observed breakdown was not entirely oxidative. Table I gives illustrative results for an unplasticized cellulose acetate butyrate powder heated under various conditions for 24 hours. The molecular weight breakdown observed in a cellulose acetate containing 38% acetyl was somewhat less than that in the acetate butyrate. Although the degradation at both temperatures was considerably

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Table II.—Oxidizability of Plasticizers[a]

Plasticizer	Apparent Oxygen Absorbed	Acid Produced	Peroxide Produced
	ml.	*milliequiv.*	*milliequiv.*
Dimethyl Phthalate	0	0	0
Diethyl Phthalate	26	2.0	1.3
Dibutyl Phthalate	52	2.3	0.5
Bis(2-Ethylhexyl) Phthalate	42	1.5	0.7
Dibutyl Sebacate	67	1.7	1.6
Tripropionin	20	1.8	1.0
Thiphenyl Phosphate	0	0	0

[a] Under oxygen for 3 hr. at 150° C.

less under nitrogen than under oxygen, the former was always a considerable fraction of the latter.

The breakdown rates exhibited by the esters themselves are rather too slow to have an important effect in the processing of cellulose ester products. Since in actual practice we are more concerned with plasticized cellulose esters, we have concentrated our studies on these systems. Here it was soon found that the type and purity of plasticizer used could have a very important influence on the oxidation and breakdown occurring at processing temperatures.

Oxidation of the Plasticizer—Oxidizability of the plasticizer alone was first investigated. The amount of oxygen absorbed by 25 ml. of the plasticizer if liquid, or 25 g. if solid, during 3 hr. of shaking at 150° C. under 1 atm. of oxygen was measured. The amounts of acid and peroxide present at the end of each run were also determined. Table II indicates the large differences observed in oxidizability of several commercial plasticizers. No absolute signficance is to be attached to the values of absorbed oxygen or to the quantities of oxidation products formed, since the volatile oxidation products were not absorbed, nor were the diffusion rates of oxygen through the different liquids determined. However, it is quite apparent that dimethyl phthalate and triphenyl phosphate are highly resistant to oxidation at 150° C., whereas the rest are rather easily oxidized. The distinguishing feature of the oxidation-resistant pair of plasticizers is the absence in their molecules of methylene or methylidyne groups, which are well known to be susceptible to oxidative attack (14).

The rather high susceptibility of such useful plasticizers as dibutyl sebacate and dioctyl phthalate to oxidation at 150° C. seemed surprising to us. We had obtained no oxidation of dibutyl sebacate at 100° C. during 60 hr. of exposure under oxygen at 100 p.s.i. in the standard bomb test for oxidizability used by Universal Oil Products for gasolines. However, Atkins, Baker, Murphy, and Zisman (15) have observed appreciable oxidation of a number of high-boiling diesters under oxygen at 125 p.s.i. over much longer periods of time at 100° C.

Oxidative Breakdown Induced by the Plasticizer—When cellulose esters were heated under oxygen in the presence of these oxidizable plasticizers, a marked increase in the rate of chain length breakdown was observed. The concentration of plasticizer used in these tests is many times higher than that used in practical compounding. It would therefore be expected that the oxidative effects would be exaggerated. Although the plasticizer itself was not in every case tested for autoxidizability, it was assumed that if the whole mixture oxidized, the plasticizer alone would likewise oxidize. Table III summarizes results obtained for cellulose acetate butyrate (13% acetyl; 37% butyryl) with a 3-hr. heat test. Very little molecular weight breakdown occurred under these conditions, either in the absence of plasticizer or in the presence of the oxidation-resistant plasticizers. Table IV gives further results with other plasticizers, this time for a 2-hr. heat test. All of these compounds behaved according to expectations, the three not containing methylene or methylidyne groups being the only oxidation-resistant members of the group.

Table III.—Induced Oxidative Degradation of Cellulose Acetate Butyrate[a]

Plasticizer	Apparent Oxygen Absorbed	Degradation
	ml.	*% mol. wt.*
None	0	0
Dimethyl Phthalate	0	11
Diethyl Phthalate	29	86
Dibutyl Phthalate	32	69
Bis(2-Ethylhexyl) Phthalate	84	76
Dibutyl Sebacate	66	71
Tripropionin	39	80
Bis(2-Ethylhexyl) Adipate	80	63
2-Methoxyethyl Palmitate	63	71
Triphenyl Phophate	0	15

[a] 1 g. ester in 25 ml. [or g.] of plasticizer heated 3 hr. at 150° C. under oxygen.

Table IV.—Induced Oxidative Degradation of Cellulose Acetate Butyrate[a]

Plasticizer	Apparent Oxygen Absorbed	Degradation
	ml.	*% mol. wt.*
Diisopropyl Phthalate	8	57
Bis (2-Methoxyethyl) Phthalate	8	57
Tris (2-Ethylhexyl) Phosphate	65	60
Tetrahydrofurfuryl Oleate	150	40
Bis(2-Ethylhexyl) Diglycolate	27	60
2,2-Dimethyl-1,3-Propanediol Bis(2-Ethylbutyrate)	56	46
Methyl Benzoate	3	10
Propyl Benzoate	34	79
Diphenyl 2,2-Dimethyl Malonate	7	0
Bis(*p-Tert*-Butylphenyl) 2,2-Dimethyl Malonate	0	19

[a] 1 g. ester in 25 ml. [or g.] of plasticizer heated 2 hr. at 150° C. under oxygen.

Table V.—Induced Oxidative Degradation of Cellulose Acetate Butyrate[a]

Plasticizer	Apparent Oxygen Absorbed	Degradation
	ml.	*% mol. wt.*
Triethyl Phosphate	0	12
Ethylene Glycol Diacetate	6	10
2,2-Dimethyl-1,3-Propanediol Diacetate	2	20
2,2-Dimethyl-1,3-Propanediol Dibenzoate	0	12
2,2-Dimethyl-1,3-Propanediol Bis(*p-Tert*-Butylbenzoate)	0	26
2,2-Dimethyl-1,3-Propanediol	0	0
Tert-Butyl Benzoate	170	51

[a] 1 g. of ester in 25 ml. [or g.] of plasticizer heated 2 hr. at 150° C. under oxygen.

In Table V are listed several plasticizers that did not react in the manner that might have been expected from their molecular structure. As before, a 2-hr. heating period under oxygen at 150° C. was used. Except for the last one in the list, all of these compounds contain methylene groups, yet their oxidizability and breakdown-inducing capacity are reduced far below normal. It is possible that the methylene groups in these materials are sterically hindered to some degree, especially in the case of 2,2-dimethyl-1,3-propanediol and its esters. The *tert*-butyl benzoate may have contained some impurity that caused the unexpected oxidation and breakdown. A result equally difficult to understand was obtained with dimethyl adipate, which failed to oxidize or cause breakdown of cellulose acetate. Here again, some impurity, this time an inhibitor, may have been present.

Inhibition of Induced Oxidative Breakdown—The oxidative breakdown of cellulose esters at 150° C., promoted by autoxidizable plasticizers, may be very effectively prevented by the addition of a small amount of inhibitor, or antioxidant. Table VI shows the protection given by a concentration of 0.08% of several types of inhibitor in a 2-hr. heat test under oxygen with dibutyl sebacate as the plasticizer. Similar results were obtained with other autoxidizable plasticizers. We found


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Table VI.—Inhibition of Oxidative Degradation of Cellulose Acetate Butyrate Plasticized with Dibutyl Sebacate[a]

Antioxidant	*Apparent Oxygen Absorbed*	*Degradation*
	ml.	*% mol. wt.*
None	35	49
2,6-*Tert*-Butyl-p-Cresol	0.5	3
N-*Tert*-Butylaniline	2	1.5
N-Phenylglycine	0	4
1,3-Diphenyl-2-Thiourea	2	14
N,N'-Diphenylacetamidine	2	13
α-Acetyl-4-[Bis(2-Hydroxyethyl)Amine]-2-Methylcinnamonitrile	0.5	16
2-[N-Ethyl-N-(p-Nitro-p-Phenylazoanilino)] Ethanol	1	0

[a] 1 g. ester in 25 ml. plasticizer heated 2 hr. at 150° C. with 0.02 g. antioxidant under oxygen.

that a large number of aromatic amines and phenols were effective, although there were a few puzzling exceptions. Some of these may be explained on the basis of interference with the functional group, such as by a hydrogen-bonding. For example, Table VII gives antioxidant ratings, based on a 2-hr. heat test with dibutyl sebacate as plasticizer, for phenyl salicylate and a number of its isomers. The isomers containing the hydroxyl groups in a position ortho to the ester linkage showed little, if any, antioxidant activity. On the other hand, little impairment of activity resulted from the presence of fairly bulky hydrocarbon substituents in the ortho position, e.g., see the first phenol listed in Table VI. Many so-called hindered phenols are finding varied application as antioxidants in the industry today.

Catalysis of Induced Oxidative Breakdown—Oxidations are generally recognized to be chain reactions (16), and, as such, it is to be expected that they will exhibit the phenomena of inhibition, as illustrated above, and of catalysis as well. The latter has been observed, for example, when peroxides are added to a system consisting of a cellulose ester and an oxidation-resistant plasticizer. In Table VIII it

Table VII.—Inhibition of Oxidative Degradation of Cellulose Acetate Butyrate[a]

Additive	*Apparent Oxygen Absorbed*	*Degradation*
	ml.	*% mol. wt.*
None	35	49
Phenyl Salicylate	44	40
Phenyl *m*-Hydroxybenzoate	25	33
Phenyl *p*-Hydroxybenzoate	24	37
Catechol Monobenzoate	16	43
Resorcinol Monobenzoate	8	8
Hydroquinone Monobenzoate	0	0

[a] 1 g. ester in 25 ml. dibutyl sebacate heated 2 hr. at 150° C. with 0.02 g. additive under oxygen.

is shown that the effect of addition of 0.05% of acetyl peroxide to a triphenyl phosphate system is to induce a breakdown similar to that occurring in the presence of an autoxidizable plasticizer without addition of peroxide. It seems likely that the reaction proceeds by way of relatively unstable peroxidic intermediates (17), either radicals or molecules or both. The peroxidic material formed during the autoxidation is, in some cases, probably more reactive than the relatively stable peroxides, such as acetyl peroxide, which are handled commercially. Cellulose esters are apparently much more easily broken down by peroxides at elevated temperatures than cellulose itself. This is shown by the utilization of this

Table VIII.—Catalysis of Oxidative Degradation of Cellulose Acetate Butyrate[a]

Plasticizer	*Catalyst*	*Atmosphere*	*Degradation*
			% mol. wt.
Triphenyl Phosphate	None	N_2	1.5
	Acetyl Peroxide	"	36
Dibutyl Sebacate	None	O_2	49
	Cupric Stearate	"	82
	Cobaltous Oleate	"	60
	Manganous Naphthenate	"	74
	Ferric Stearate	"	67
	Nickelous Stearate	"	73
	Chromic Stearate	"	89
	Silver Stearate	"	67

[a] 1 g. ester in 25 ml. [or g.] of plasticizer at 150° C.

effect on the burn-out process for removing cellulose acetate from mixed fabrics (18).

Oxidative breakdown may also be catalyzed by a number of heavy metal soaps. The results of some of these experiments have been included in Table VIII; a 2-hr. heating period was used in these experiments. According to Robertson and Waters (17), copper and cobalt compounds accelerate oxidation reactions by catalyzing the decomposition of the peroxidic intermediates. Soaps of metals like aluminum, zinc, and cadmium did not act catalytically in our experiments. Titanium dioxide, however, did exert a pronounced catalytic effect on the oxidative breakdown under the conditions of the experiments summarized in Table IX. Addition of an antioxidant prevented this degradation. In these experiments, cellulose acetate butyrate plasticized with 12 parts of dibutyl sebacate was heated for 48 hr. in an oven at 130° C. Pigment and antioxidant, when used, were present in a concentration of 1 percent.

A very interesting phenomenon was noted in the case of cupric stearate. This compound catalyzed oxidation and breakdown in the dibutyl sebacate system, as shown in Table VIII, but retarded these reactions in the diethyl phthalate system. Figure 1 illustrates the effect of addition of 0.08% of cupric stearate on the rate of oxygen take-up by these two plasticizers at 150° C. George and Robertson have discussed similar opposing effects (19), or positive and negative catalysis, exhibited by heavy metal compounds in oxidation reactions. These phenomena emphasize the importance of proper choice of stabilizer to be used with any given plastic system. In the stabilization of polyvinyl chloride plastics, Lally and Hansen (20) have pointed out the necessity of matching the stabilizer to the plasticizer, colorant, and other components of the plastic system.

Thermal, Non-oxidative Breakdown—Cellulose ester plastics can be thermally unstable for reasons other than oxidizability. The pronounced degrading action of traces of strong mineral acids in cellulose ester systems is well known (1). Cellulose esters must be carefully purified and stabilized against release of acidic matter on heating

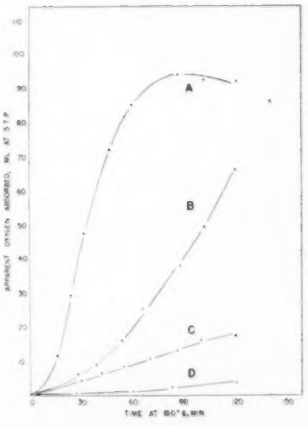

Fig. 1—Positive and negative catalysis of oxidation by cupric stearate. A, dibutyl sebacate + 0.08% cupric stearate; B, bibutyl sebacate; C, diethyl phthalate; D, diethyl phthalate + 0.08% cupric stearate

Table IX.—Catalysis of Oxidative Degradation of Cellulose Acetate Butyrate[a] by Titanium Dioxide and its Inhibition by Antioxidant

Pigment	*Antioxidant*	*Degradation*
		% mol. wt.
None	None	3
Titanium Dioxide	None	87
	p-Tert-Butylphenol	2
	2,6-Di-*Tert*-Butyl-p-Cresol	3

[a] 1 g. ester with 0.12 g. dibutyl sebacate and 0.01 g. pigment [if any] and 0.01 g. antioxidant [if any] heated 48 hr. in oxygen at 130° C.

(21) before they can pass the specifications for heat stability. Plasticizers must also be acid-free. The degrading effect of 0.08% of concentrated sulfuric acid is illustrated by Table X. In these experiments, 1 g. of cellulose acetate butyrate was heated for 3 hr. at 150° C. in 25 ml.

Table X.—Thermal Degradation of Cellulose Acetate Butyrate[a]

Degradation Catalyst	*Inhibitor*	*Degradation*
		% mol. wt.
None	None	2
Conc. H_2SO_4	None	97
Conc. H_2SO_4	4-Phenyl-Thiosemi-carbazide	3
Ferric Sulfate	None	98
Ferric Chloride	None	96
Ferric Stearate	None	0
Ferric Oxide	None	0
Ferrous Sulfate	None	0
Iron Powder	None	4

[a] 1 g. ester in 25 ml. diethyl phthalate heated at 150° C. under nitrogen with 0.02 g. antioxidant added.

of diethyl phthalate. To guarantee a minimum of oxidative breakdown, 0.02 g. of an effective antioxidant was added, and the heating was carried out under an atmosphere of nitrogen. Addition of 0.2 g. of the acid acceptor, 4-phenyl-thiosemicarbazide, counteracted the degrading effect of the sulfuric acid.

The catalytic action of certain metallic impurities on the thermal breakdown is perhaps not so well-known. It was found that some ferric salts of strong acids were remarkably active in this respect, but that other iron compounds, including iron powder itself, were quite inert. Many other metallic compounds (e. g., cupric sulfate, chromic sulfate, nickelous chloride, cobaltous acetate, manganous acetate, and vanadium stearate) were also without effect on this type of breakdown. These tests were carried out in the same way as those for acid breakdown and are included in Table X. Each metallic compound was added to the extent of 0.08 percent.

Occasionally, batches of plasticizer (e. g., diethyl phthalate) that cause objectionable thermal breakdown when incorporated into cellulose ester plastics are encountered. Such batches are, of course, screened out by the heat stability tests that are carried out as a part of the regular quality control procedures. These batches may contain neither free acid nor peroxide detectable by the ordinary chemical analysis. Iron contamination was found, however, by spectrographic analysis. The stability of the plastic prepared from such a plasticizer could be greatly improved by the addition of a suitable metal deactivator, or chelating agent. Table XI summarizes these experiments, which were run under the same conditions as those of Table X.

Batches of diethyl phthalate, made unstable by the addition of ferric salts, could likewise be corrected by the addition of certain chelating compounds. The examples included in Table XI were 2-hr. tests with 0.1 g. of chelating inhibitor and 0.002 g. of ferric chloride instead of the usual 0.02 grams.

Breakdown by Ultra-violet Light

Effect of Plasticizer—Since the plasticizer was found to play such an important part in the breakdown by heat, this variable was investigated in the weathering process. In addition to variations in photo-oxidizability from one plasticizer to another, there are, of course, the variations in ultra-violet absorption to be considered. Meyer and Gearhart (6) have reported, for example, that aromatic plasticizers contribute some protection against ultra-violet breakdown by virtue of their increased absorption over that of aliphatic plasticizers.

Table XII shows the extent to which the concentration of dibutyl sebacate affects the degradation taking place during 4 mo. of exposure to the weather at Kingsport, Tenn. That the effect is not greater is probably due to the fact that in this system the light is primarily absorbed by the cellulose ester. Thus it might be expected that the photo-oxidation of the plasticizer and the breakdown induced thereby in the cellulose ester would play a secondary role.

Table XII.—Effect of Plasticizer Concentration on Outdoor Weathering Breakdown in Cellulose Acetate Butyrate Plastic[a]

Dibutyl Sebacate per 100 Parts Cellulose Ester	*Degradation*
parts	*% mol. wt.*
0	9.5
1	11.8
2	13.4
4	16.3
8	17.7
12	16.5
16	14.7
20	16.5
25	18.8

[a] Plasticizer: dibutyl sebacate; sample thickness: 0.050 inch.

Another experiment apparently illustrating the deleterious effect of an oxidizable plasticizer on the weathering resistance of the plastic was one in which the breakdown occurring in a thin sample was compared with that occurring in an equally thin outside layer of a thick sample. In Table XIII are listed the decreases in molecular weight during both natural and accelerated weathering of clear and pigmented thin plastic sheets as compared with the corresponding decreases in equally thin outside layers of thick samples, milled off after exposure. Twelve parts of dibutyl sebacate were used in both clear and pigmented formulations, the latter containing in addition 2 parts of pigment. The plasticizer content of the thin pieces, as the result of evaporation and leaching during exposure, would remain well below that of the outside layers of the thick pieces, which would be kept supplied with fresh plasticizer by diffusion from the internal reservoir. Breakdown in the outside layers of the thick pieces was considerably greater than in the corresponding thin samples

Table XI.—Inhibition of Thermal Degradation of Cellulose Acetate Butyrate[a]

Quality of Diethyl Phthalate	*Added Degradation Catalyst*	*Inhibitor*	*Heating Time*	*Degradation*
			hr.	*% mol. wt.*
"Bad"	None	None	3	99
		N,N'-Disalicylidene-1,2-Propanediamine	3	6
"Good"	Ferric Chloride	None	2	81
		1,3-Diphenyl-2-Thiourea	2	17
	Ferric Sulfate	None	2	92
		β-Isothioureido-Propionic Acid	2	3

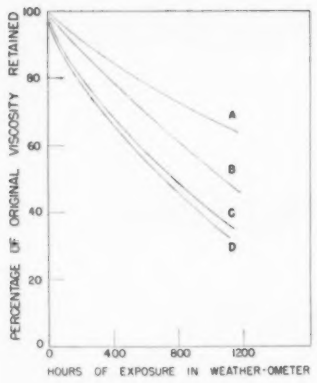

Fig. 2—Post-irradiation breakdown in cellulose acetate butyrate plastic. A, in acetone, no heating; B, in pyridine, no heating; C, in pyridine, heated 15 hr. at 80° C.; D, in pyridine, heated 35 hr. at 80° C.

from which the plasticizer was allowed to escape during exposure.

The apparent effect of plasticizer concentration in this indirect experiment is so much greater than would have been expected from the previous direct experiment that we must suspect an additional effect acting in the same direction to cause the milled-off layer to show more breakdown. This is perhaps to be found in the well-known thermal instability characteristic of cellulosic compounds that have been irradiated by ultra-violet light (4, 5, 22). The heat generated by the milling operation may have been sufficient to cause considerable additional breakdown. The extent to which such a dark reaction proceeds in cellulose acetate butyrate after exposure may be seen in Fig. 2. Viscosities of dilute pyridine solutions of exposed samples were markedly lowered by heat treatments too mild to affect the viscosity of unexposed material.

Table XIII.—Effect of Sample Thickness on Weathering Breakdown in Cellulose Acetate Butyrate Plastic[a]

Pigmentation	*Sample Thickness*	*Outer Layer Degradation[b] Outdoor[c]*	*Accelerated[d]*
	in.	*% mol. wt.*	*% mol. wt.*
None	0.010	15.1	21.2
None	0.187	49.0	85.0
Titanium Dioxide	0.010	3.3	18.6
Titanium Dioxide	0.187	14.3	65.0

[a] Plasticizer content: 12 parts dibutyl sebacate per 100 parts cellulose ester.
[b] Layer thickness: 0.010 inch.
[c] 6 months in Kingsport, Tenn.
[d] 1000 hr. in Atlas Twin-Arc Weather-ometer.

These viscosity decreases were accompanied by the development of a yellowish-brown color, the intensity of which was proportional to the previous irradiation received.

Effect of Oxygen—The effects of oxygen in the photodegradation process itself may be demonstrated easily by accelerated exposures in sealed quartz tubes. Table XIV shows a comparison of the breakdowns observed in unplasticized cellulose acetate butyrate during exposure in the Weather-ometer, both in the usual unprotected manner and sealed inside quartz tubes, either under air or nitrogen atmosphere. Elimination of oxygen reduced breakdown considerably.

Table XIV.—Breakdown of Cellulose Acetate Butyrate in Sealed Quartz Tubes[a]

Exposure Conditions	*Degradation*
	% mol. wt.
Unprotected	44
Sealed in air	44
Sealed in nitrogen	12

[a] 800 hr. of exposure in Weather-ometer.

Haze Formation in Unplasticized Ester—A curious effect was noted in the weathering of the unplasticized cellulose acetate. During unprotected exposure, either outdoors or in the Weather-ometer, an opaque, white layer developed on both front and back surfaces. Since this did not occur in either sealed-tube exposure, it is assumed to be the result of a photochemical reaction involving moisture. The presence of only small concentrations of plasticizer is required to prevent the formation of this white haze during weathering. This effect is illustrated in Fig. 3, which shows the appearance, before and after 350 hr. of exposure in the modified Weather-ometer, of cellulose acetate butyrate samples having 0 to 12 parts dibutyl sebacate.

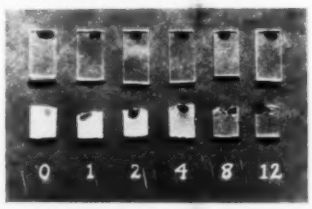

Fig. 3—Effect of plasticizer concentration on development of haze during weathering of cellulose acetate butyrate plastic. Numerals denote the parts of dibutyl sebacate

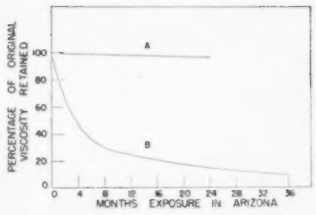

Fig. 4—Viscosity breakdown in sunlight. A, as used with 1% phenyl salicylate; B, uninhibited

Phenyl Salicylate as an Ultra-violet-Breakdown Inhibitor—In actual practice, a breakdown inhibitor, such as phenyl salicylate, is added to cellulose ester plastics for outdoor use. Fig. 4 illustrates the remarkable effectiveness of 1% of phenyl salicylate in preventing breakdown in $\frac{3}{16}$-in.-thick samples of cellulose acetate butyrate, plasticized with 12 parts of dibutyl sebacate, during exposure in Arizona (6). It has been found difficult to improve on this inhibitor for a colorless and non-coloring outdoor plastic formulation. The great weakness of phenyl salicylate is its escaping tendency, which limits its use to relatively thick articles. As shown by Table XV, the protection afforded by 1% of phenyl salicylate, in a plastic the same as referred to in Fig. 4, decreases quite rapidly with decreasing thickness. Layers 0.025-in. thick were milled off the thicker pieces for comparison with the thinnest piece which had a total thickness of 0.025 in. These pieces had each received 20 mo. of exposure in Arizona. The situation with the protected plastic is thus seen, by comparison with Table XIII, to be just the reverse of that in the unprotected plastic. In the latter case, the thin surface layers on thick pieces were more degraded than corresponding individual thin pieces. The excessive break-

Table XV.—Effect of Sample Thickness on Outdoor Weathering Breakdown in Cellulose Acetate Butyrate Plastic Protected by Phenyl Salicylate[a]

Sample Thickness	*Outer Layer Degradation[b]*
in.	*% mol. wt.*
0.125	20
0.100	30
0.075	45
0.050	85
0.025	70

[a] Exposed 20 months in Arizona.
[b] Layer thickness: 0.025 inch.

(*Continued on p. 185*)

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

EXPANDING PRODUCTION AND EXPORTS OF PLASTICS IN WESTERN GERMANY. Brit. Plastics *24*, 412-13 (Dec. 1951). Detailed statistics on the production and exports of plastics from Western Germany for the period Jan. 1948 through June 1951 are presented. The total production has expanded nearly five-fold in this period.

RESEARCH PROGRESS IN DIELECTRICS. A. E. Javitz. Electrical Manuf. *49*, 90-6, 230, 232, 234, 236, 238, 240 (Jan. 1952). Recent progress in the development of dielectric materials is reviewed. Resumes of the papers in this field that were presented at the 20th Annual Conference on Electrical Insulation are presented. The emphasis has been to develop materials capable of withstanding high temperatures. Data on mica papers, glass, ceramics, and plastics are presented in this article.

Materials

FILMS DERIVED FROM STYRENE-MALEIC ANHYDRIDE AND STYRENE-MONOETHYL MALEATE HETEROPOLYMERS. R. G. Heligmann and E. E. McSweeney. Ind. Eng. Chem. *44*, 113-16 (Jan. 1952). Styrene-maleic anhydride heteropolymers and derivatives have long been known and have enjoyed application in the textile field. More recently they have been used as thickening and stabilizing agents, adhesive ingredients, protective colloids, coating resins, and emulsifying agents. There are distinct differences in the solubility characteristics of films cast from ammoniacal solutions of heteropolymers of styrene-maleic anhydride and styrene-monoalkyl maleates. While polymers prepared from styrene-monoalkyl maleates evidence marked solubility in aqueous ammonia, air-dried or mildly baked films prepared from such a solution are essentially insoluble in water. Aqueous insolubility in the case of the half-ester heteropolymer could be realized under mild drying conditions without resorting to the use of typical insolubilizing agents, such as glycols, diamines, and formaldehyde. Films prepared from the sodium salts of the lower alkyl half-ester heteropolymers do not exhibit this aqueous cold-film insolubility when dried under relatively mild conditions.

CHLORINATED RUBBER FROM LATEX. G. J. van Amerongen. Ind. Eng. Chem. *43*, 2535-40 (Nov. 1951). Attempts to find new ways for producing chlorinated rubber from rubber latex are described. Methods are applied in which coagulation of the latex and hydrochlorination of the rubber are avoided. Passing gaseous chlorine through stabilized and strongly acidified Hevea latex is a satisfactory method for the chlorination of rubber. To avoid coagulation of the latex certain nonionogenic or cationogenic emulsifiers are added. A high acidity of latex prevents the formation of hypochlorous acid and improves the mechanical stability of the latex. A chlorinated rubber latex is produced, the chlorinated rubber of which contains virtually no oxygen and up to 61% of chlorine. By subjecting this chlorinated rubber latex and hydrochlorination of the rubber to an aftertreatment, products of a satisfactory solubility and with a chlorine content up to 72% are obtained. Judging from the reactivity with aniline, maximum chemical stability is at 65% chlorine content.

TRANSLUCENT FILMS OF ACRYLIC ACID ESTERS-ACRYLONITRILE COPOLYMERS. F. Leonard, I. Cort, and T. B. Blevins. Ind. Eng. Chem. *43*, 2500-06 (Nov. 1951). Translucent elastomeric films in pastel shades, low pressure cast from polymeric emulsions, are required for the fabrication of skin-colored gloves to be worn by amputees. In order to augment strength properties without unduly affecting translucency, investigation of the reinforcing effect of an isotropic silica was undertaken. Cast films containing the silica showed an enhancement in strength properties over uncompounded films, and films containing up to 40 parts of silica per 100 parts of dry copolymer suffered only slight loss in translucency in the unstrained state. However, as the compounded films were strained, they showed a marked increase in whiteness and opacity as compared to uncompounded films. Possible explanations of this effect are given. Through this study it has been found possible to reinforce latex copolymers in emulsion form with an aqueous dispersed filler, which did not appear to increase the opacity of the cast film.

Molding and Fabricating

SILVERING OF PLASTICS. D. McPherson. Brit. Plastics *24*, 383-4 (Nov. 1951). The general principles of depositing a film of metal from solutions onto surfaces are reviewed. A new chemical process for depositing a conducting layer of silver on plastics is described. The adhesion obtained by this process is reported to be very good.

POTTED ELECTRONIC CIRCUITS. E. N. Shaw, H. G. Manfield, and K. Atkinson. Plastics (London) *16*, 336-7 (Dec. 1951). Electronic equipment is potted in cast polyester plastics. The procedure for preparation of the assemblies, the fillers, the effects of various catalysts and accelerators, and the curing operation are fully described.

Applications

MOULDED WINGS FOR DELTA AIRCRAFT. Brit. Plastics *24*, 334-7 (Oct. 1951). A wing for a small airplane is molded of a phenolic resin-asbestos laminate. Construction and molding details are described.

LOW-PRESSURE LAMINATES FOR AIRCRAFT. Brit. Plastics *24*, 415-20 (Dec. 1951). The fabrication of aircraft parts in England from glass fabric and polyester resins is described in detail. Radomes, ducts, honeycomb-sandwiches, airfoils, and loop housings are considered.

APPLICATION OF SOME EPOXIDE RESINS IN THE PLASTICS INDUSTRY. E. S. Narracott. Brit. Plastics *24*, 341-5 (Oct. 1951). The use of epoxide resins as stabilizers for polyvinyl chloride and other chlorinated com-

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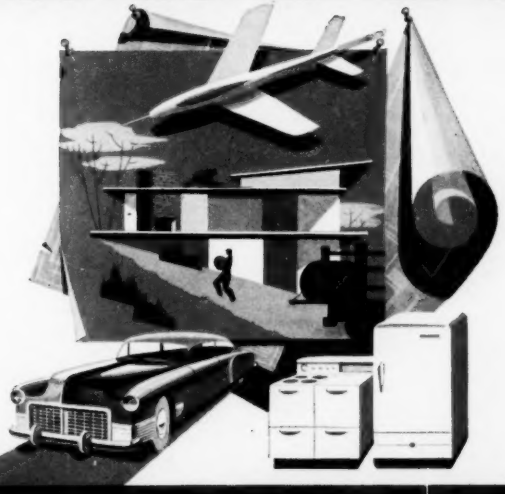

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pounds for making glass fiber laminates, pottery compounds, and adhesives is discussed. The synthesis and cure with amines is described. Results of tests to evaluate these applications are reported.

Properties

UTILIZATION OF ULTRASONICS IN THE PLASTIC INDUSTRY. W. S. Penn. Plastics (London) *16*, 317–19, 351–2 (Nov., Dec. 1951). The principles involved in the use of ultrasonics and their application to polymerization, degradation, and measurements of physical constants of polymers are reviewed. Twenty-two references.

AN ANOMALOUS PROPERTY OF POLYVINYL ALCOHOL MEMBRANES. H. T. Hookway and R. Townsend. Research *4*, 380–1 (Aug. 1951). The rates of transmission of benzene and polystyrene through water-swollen membranes of polyvinyl alcohol decrease as the degree of swelling is increased. This is the opposite to that found with cellulose membranes used in osmotic pressure measurements.

EFFECTS OF ALKATHENE UPON WATER QUALITY. E. F. W. Mackenzie. J. Institution of Water Engineers *5*, 596-604 (Oct. 1951). The polyethylene pipe used in these tests imparted an objectionable taste to water. This taste would be less likely to develop in homes and small farms where stagnation is less likely to occur and where an occasional taste would be less likely to lead to complaint. This pipe is not recommended for use in large buildings involving long runs, raised water temperatures, and possibly stagnation until comprehensive tests are made with a variety of waters and embodying more conditions. This pipe is particularly suitable for conveying strong solutions of chlorine, sulfur dioxide, and other corrosive substances.

Testing

DETERMINATION OF SODIUM CARBOXYMETHYL CELLULOSE IN DETERGENT MIXTURES. H. C. Black, Jr. Anal. Chem. *23*, 1792–5 (Dec. 1951). A method was needed for determination of sodium carboxymethyl cellulose in household detergents. The green color formed by reaction of anthrone with carbohydrate materials in sulfuric acid solution provided the basis for the present method. Color intensity is measured with a spectrophotometer. Controlled heating is necessary for reproducible results. Color intensity varies inversely with degree of substitution of the carboxymethyl cellulose. The accuracy is 2% relative, provided the degree of substitution is known. Other carbohydrates, carbohydrate derivatives, furfural, 5-hydroxymethylfurfural, and certain polyoxyethylene derivatives of fatty acids and phenols are the only known interfering substances. The method should be useful for determination of carboxymethyl cellulose in other mixtures and, with appropriate modification, of other carbohydrates and their derivatives.

PLASTICIZER QUALITY TEST. C. J. Malm, L. B. Genung, and M. L. Townsend. Anal. Chem. *23*, 1692-4 (Nov. 1951). Plasticizer quality is determined by heating the material in which a strip of ashless filter paper is immersed. Discoloration indicates the presence of undesirable impurities which are shown to affect adversely the stability of cellulose plastics.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U.S. Patent Office, Washington, D.C., at 25¢ each.

PLASTIC COMPOSITIONS. W. C. Klingel. U.S. 2,576,945, Dec. 4. Plasticizing plastics with rubbers.

COPOLYMERS. R. B. Seymour (to Univ. of Chattanooga). U.S. 2,577,-041, Dec. 4. Reaction products of copolymers of maleic anhydride and monovinyl compounds and chlorophenols.

ALKYD ISOCYANATE RESINS. E. Simon and F. W. Thomas (to Lockheed). U.S. 2,577,279-80-1, Dec. 4. Foamed and flame retardant alkyd-isocyanate resins.

CASTING. G. L. Fraser and H. F. Park (to Monsanto). U.S. 2,577,414, Dec. 4. Casting composition of styrene-polyester copolymer.

TALL OIL. P. C. Hamm (to Monsanto). U.S. 2,577,418, Dec. 4. Tall oil melamine reaction product.

BOOKBINDING. L. D. deFlorez, P. deFlorez, and O. L. Gore (to deFlorez Co.). U.S. 2,577,568, Dec. 4. Plastic binding of hard cased books.

POLYESTERS. D. W. Jayne and H. M. Day (to American Cyanamid). U.S. 2,577,618, Dec. 4. Rubber-like polyesters containing calcium silicate.

LIGHT POLARIZER. J. Mahler (to American Optical). U.S. 2,577,620, Dec. 4. Molecularly oriented sheet of transparent plastic.

POLYAMIDES. G. B. May and J. W. Fisher. U.S. 2,577,621, Dec. 4. Polyamides of high molecular weight containing 1:4-bis(3-aminopropoxy) cyclohexane.

VINYLIDENE CHLORIDE. E. D. Serdynsky, J. S. Gowing, R. M. Wiley, and C. B. Havens (to Dow). U.S. 2,577,635, Dec. 4. Vinylidene chloride polymer containing alkyl polyphosphates as antistatic agents.

COATINGS. P. E. Marling (to Monsanto). U.S. 2,577,709, Dec. 4. Coatings comprising reaction product of vinyl esters of tall oil acids with styrene and isopropenyl compound.

INSULATION. A. Rheiner and W. Hagenbuch (to Sandoz). U.S. 2,577,-715, Dec. 4. Insulation consisting of a heat and pressure laminate of acetylated paper bonded with phenolic resin.

CELLULAR PRODUCT. C. E. DeLong (to Dow). U. S. 2,577,743, Dec. 11. Plastic gel containing blowing agent and a stearate.

ION EXCHANGE. G. F. Jones (to Imperial Paper and Color). U. S. 2,-577,767, Dec. 11. Cationic melamine-aldehyde resins.

ALKYD RESINS. P. Kass and Z. W. Wicks (to Interchemical). U. S. 2,577,770, Dec. 11. Alkyd resin including pentaerythritol.

POLYMERS. R. C. Morris, V. W. Buls, and S. A. Ballard (to Shell Development). U. S. 2,577,796, Dec. 11. Polymeric esters of phosphorous acids.

POLYETHYLENE. H. G. Schneider, D. W. Young, and J. P. Rocca (to Standard Oil). U. S. 2,577,816, Dec. 11. Composition of polyethylene and a chlorinated wax.

COPOLYMERS. W. J. Sparks and R. M. Thomas (to Jasco). U. S. 2,-577,822, Dec. 11. Cyclodiene isobutylene copolymers.

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COPOLYMERS. H. S. Bloch (to Universal Oil Products). U. S. 2,578,-168-9, Dec. 11. Copolymers of ethylenically unsaturated compounds with a polyolefinic cyclic hydrocarbon.

MOLDS. H. G. Schwarz (to Art Electrotype). U. S. 2,578,209, Dec. 11. Method of making thermoplastic electrotype molds.

COPOLYMERIZATION. E. B. McMillan (to U. S.). U. S. 2,578,259, Dec. 11. Copolymerizate of dichlorostyrene and maleic anhydride.

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POLYMERS. R. J. S. Jennings and A. F. Williams (to C. D. Patents). U. S. 2,578,479, Dec. 11. Process for the polymerizing of bis(diphenylene) ethylene.

POLYTETRAFLUOROETHYLENE. D. E. Edgar and W. E. Llewellyn (to Du Pont). U. S. 2,578,522-3, Dec. 11. Films and packing material of polytetrafluoroethylene.

POLYMERIZATION. L. A. Auspos and J. B. Dempster (to Du Pont). U. S. 2,578,600, Dec. 18. Polymerization of ethylene glycol terephthalate in the presence of germanium.

COATED PLASTIC. J. Bjorksten, S. O. Fiedler, and L. L. Yaeger (to Nash-Kelvinator). U. S. 2,578,665, Dec. 18. A polystyrene surface having bonded thereto an acrylic coating.

COATINGS. S. O. Fiedler, J. Bjorksten, and L. L. Yaeger (to Nash-Kelvinator). U. S. 2,578,683, Dec. 18. Composition of cellulose acetate hydrogen phthalate and polymethyl methacrylate.

PLASTICIZERS. G. L. Fraser (to Monsanto). U. S. 2,578,688, Dec. 18. Vinyl resins plasticized with trimethylol propane trioctanoate.

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LIGNIN COMPOUNDS. W. C. Goss (to U. S. Sheetwood). U. S. 2,578,695, Dec. 18. Thermosetting binder comprising a mixture of brown rotted wood, ammonium hydroxide, and a phenol.

MOLDING. J. W. Mayer and W. F. St. Clair (to Autograf Brush and Plastics). U. S. 2,578,719, Dec. 18. Injection molding apparatus.

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PLASTICIZERS. J. K. Stevenson (to Niagara Alkali). U. S. 2,578,853, Dec. 18. Alkoxychlorobenzenes as plasticizers for nitrile rubber.

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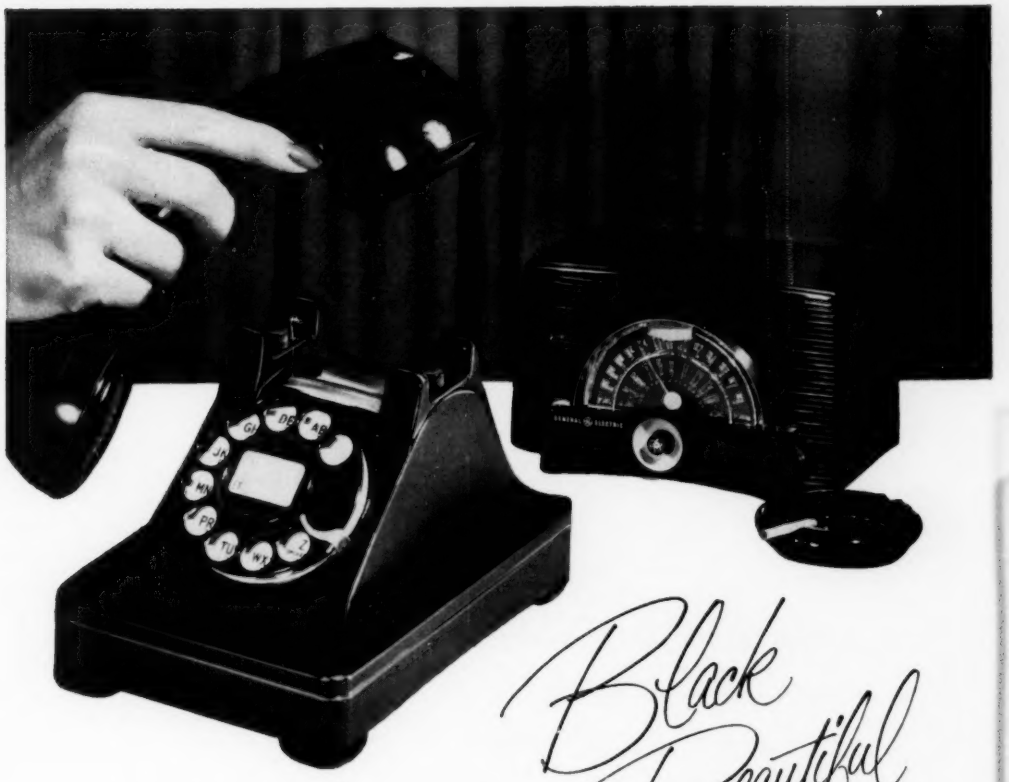

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Pont). U. S. 2,578,899, Dec. 18. Superstretching polyester structures.

CHLORINATED POLYMER. G. S. Stamatoff (to Du Pont). U. S. 2,578,904, Dec. 18. Treating chlorinated polyethylene with propene oxide and a protein.

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POLYESTERS. J. R. Scheibli, R. C. Morris, and E. C. Shokal (to Shell Development). U. S. 2,578,950, Dec. 18. Polymers of unsaturated esters of *tert*-butyl benzoic acid.

INTERPOLYMERS. M. Naps and F. E. Condo (to Shell Development). U. S. 2,579,008, Dec. 18. Interpolymers of methacrylonitrile, acrylonitrile, and vinyl acetate.

COPOLYMERS. D. W. Woodward (to Du Pont). U. S. 2,579,061, Dec. 18. Copolymers of hydrogen cyanide with an ethylenically unsaturated monomer.

SEAMING. A. M. Andrews. U. S. 2,579,063, Dec. 18. Heated pressure seaming device for plastics.

INTERPOLYMERS. P. O. Tawney (to U. S. Rubber). U. S. 2,579,079, Dec. 18. Interpolymers of unsaturated ethers with unsaturated esters.

PHOTOPOLYMERIZATION. C. C. Sachs and J. Bond (to A. H. Kerr). U. S. 2,579,095, Dec. 18. Photopolymerizing unsaturated resin-forming compound.

SHEET MATERIAL. A. Burness and E. G. Williams (to I. C. I.). U. S. 2,579,138, Dec. 18. Polymerization of material in sheet form.

VINYL POLYMER. C. J. Van der Valk (to Heyden). U. S. 2,579,219, Dec. 18. Vinyl polymer containing as plasticizer an ester of a pentaerythritol hydroxyalkyl ether.

METHYLOL PHENOLS. R. W. Martin (to G. E.). U. S. 2,579,329-30-1, Dec. 18. Trimethylol phenols and derivatives thereof.

POLYSILOXANES. H. C. Nelson, Jr. (to G. E.). U. S. 2,579,332, Dec. 18. Increasing viscosity of liquid polysiloxanes.

NONSTATIC COMPOSITION. J. B. Eisen (to Monsanto). U. S. 2,579,375, Dec. 18. Molded polystyrene containing a quaternary ammonium salt.


MT. VERNON EXTRA
UNIFORMITY
Makes the
Big Difference
in LAMINATION
Fabrics
Mt. Vernon - Woodberry Mills
TURNER HALSEY
COMPANY
Selling Agents
40 WORTH ST NEW YORK

NEW MACHINERY AND EQUIPMENT

STATIC BALANCING—Developed on a principle for quickly bringing into balance grinding, polishing, or buffing wheels, the new Speedi-Balancer has been introduced by Anderson Bros., Mfg. Co., 1907 Kishwaukee St., Rockford, Ill. With this device, wheels can be removed or replaced without adding or removing weights. The wheel is marked to show the setting of the Speedi-Balancing disks; any time the wheel is replaced, the balancer is set according to the marking. The balancers are made to fit arbor sizes from ½ to ⅞ in. and from 1 to 1¼ in.

THERMATRON WELTING MACHINE—Utilizing Thermatron electronic heat sealing equipment, a fully automatic welting machine, of particular interest to large users of plastic binding, has been developed by Thermatron Div., Radio Receptor Co., Inc., 251 West 19 St., New York 11, N.Y. The machine simultaneously feeds five sizes of slit-rolled vinyl plastic onto five separate reels and rewinds the finished binding into tight rolls, ready to use or ship. It can make and seal welting or gimp or both in any combination and is also adaptable to making other continuous products for industrial use. Production rate is from 5000 to 6000 ft. per hr., depending on design of welting or gimp.

Because of the ease of operation—only one person is required for inspection and the simple loading of the reels—the machine is practical for both long and short runs. Another feature is the elimination of expensive rejects due to poor sewing. The machine requires approximately 12 by 4 ft. of floor space.

HOT STAMPING AND EMBOSSING PRESSES—Developed for hot stamping or embossing plastics, leather, imitation leather, cloth, silk, celluloid, and other materials, a new line of presses has been announced by Craftsmen Machinery Co., 575 Atlantic Ave., Boston 10, Mass. Included in the line are three hand-operated, bench models—the Utility, with a bed size of 8 by 8 in.; the Universal, 9¾ by 10⅜ in.; and the Super, 11¾ by 13⅞—each equipped with sliding bed, electrical heated head, automatic roll leaf attachment, feed table with drawer, and sliding head plate for mounting dies. Pressure is applied by hand lever and toggle action.

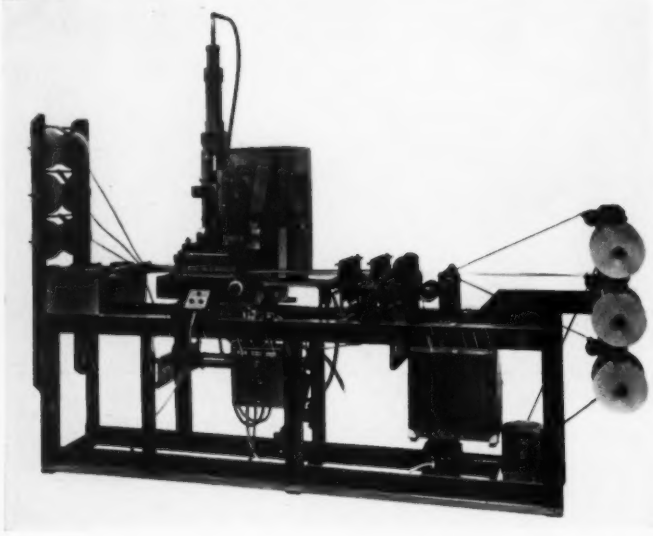
Two motorized semi-automatic machines—the Superior, 11⅛ by 16⅛ in., and the Junior, 9⅜ by 12¼ in.—are equipped with automatic sliding bed and roll leaf attachment, electric-heated head, three-way switch for heat, and an AC motor mounted in the base.

AUTOMATIC CYCLE CONTROLLER—Suitable for use in the rubber and plastics industries where press "bumping" or "breathing" is essential, a new automatic cycle controller (Robotron E304) is being manufactured by Emmet Machine & Mfg., Inc., 2249 Fourteenth St., S.W., Akron 14, Ohio. Capable of accurate timing and close control of press opening distance, the controller features pushbutton keyboards to set up cycles in a few seconds. The machine includes operating pushbuttons facing the press operator; keyboard cover, with lock, at the side; solenoid valve; and internal pressure switch. Rugged electrical control elements, without electronic tubes, help in keeping maintenance low and dependability high.

TAPPING HEAD—Embodying new principles of control, this new tapping head for tapping 0-80 to 4-40 holes in steel or other material at high speed and with sensitive feel, has been designed by the Winslow Product Engineering Corp., 5420 Jillson St., Los Angeles 22, Calif. The head is mounted to the spindle of a standard drill press and since provision for vertical travel is built directly into the head itself, neither the control lever on the press nor the vertical travel of the spindle are utilized. The tapping operation is controlled by light pressure on the knurled collar just above the tap.

A special factory-adjusted clutch prevents overloading the tap when tapping 0-80 or 1-72 holes; for larger holes, no special protection is required and this clutch is locked.

Easily operated automatic welting machine employs electronic heat sealing equipment

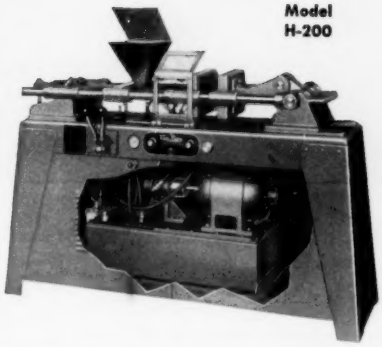


Model H-200

SEMI-AUTOMATIC INJECTION PRESS

2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

Model H-200



Power Operated, Lever Controlled Presses—Available in 2-oz. or 1-oz. models. These profit-makers feature: Rugged all-welded construction; built-in safety devices; heating chamber with ample plasticizing capacity.

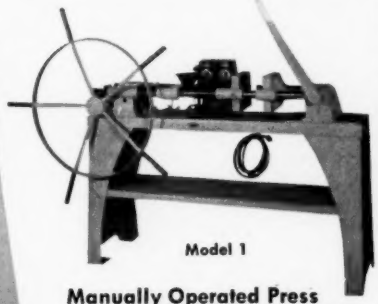
VAN DORN
Plastic Equipment

COSTS LESS to Buy...to Operate!

Van Dorn presses are *unexcelled in efficiency* and *unequalled in economy* on the innumerable jobs where a 2-oz. injection is ample. Costwise, Van Dorn presses are outstanding for these reasons:

1. **Surprisingly low in price**
2. **Operate 8 hours for a few dollars**
3. **Use less expensive molds**
4. **Easily set up by one man in a few minutes**

These presses mold practically all thermoplastics including nylon . . . Look over the Van Dorn presses and plastic equipment shown—*then write for detailed Bulletins on individual machines.*

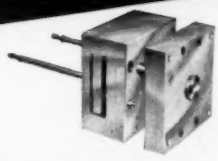


Model 1

Manually Operated Press
1-oz. capacity. Ideal for smaller jobs, experimental work, training.

Plastic Grinder
Grinds up rejects, waste, etc., for re-use. Ruggedly made, easily cleaned.

Model G-100



Mold Bases
. . . Available from stock for all Van Dorn presses.

THE Van Dorn IRON WORKS CO.
2687 EAST 79th STREET • CLEVELAND 4, OHIO
Cable Address: "VANDORN" Cleveland

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Plastics Moulding Engineering," by M. Feund.

Published in 1952 by The British Book Centre, Inc., 122 East 55 St., New York 22, N.Y. 409 pages. Price $10.00

A comprehensive study of the principles and methods employed in the molding of plastics, together with a description of the results obtainable and the limitations that must be taken into account, are offered in this new book. The tooling of moldings, both thermosetting and thermoplastics, is covered in detail. Other chapters present information on stresses in plastics molds; molding of large components; tolerances, mechanical performance, and physical behavior of moldings; threads and inserts; heat and hydraulics in the shop; and unusual mold designs. Cross-section diagrams, graphs, tabular data, photographs, and equations complement the text. Included also is an Appendix presenting formulas and tables for determining the surface area of regular polygons and solids, the volumes of rings and disks, and the volumes and weights for moldings of various sections and shapes.

"Copolymerization," by Turner Alfrey, Jr., John J. Bohrer, and H. Mark.

Published in 1952 by Interscience Publ., Inc., 250 Fifth Ave., New York 1, N.Y. 269 pages. Price $6.80

Eighth volume in a series of monographs on the chemistry, physics, and technology of high polymeric substances, this book is a systematic account of all the copolymerization investigations of the experts closely connected with this field. Analyzed in detail are the reaction mechanisms of copolymerized systems, particularly the monomer distribution in such systems. Other topics include kinetics of copolymerization; monomer structure and reactivity with free radicals; monomer reactivities in terms of resonance and polarity; effect of temperature and environment on copolymerization reactivity ratios; polymerization of tri- and multi- component systems; structure of copolymer chains; rates and molecular weights in copolymerization; and copolymerization by means of ionic mechanisms.

"Chemistry of Carbon Compounds," edited by E. H. Rodd.

Published in 1952 by Elsevier Press, Inc., 402 Lovett Blvd., Houston 6, Texas. 777 pages. Price $18.00

The first volume in a series designed as reference works for organic chemists, this book is composed of a general introduction and a collection of papers on aliphatic compounds. Included among the subjects dealt with are the saturated or paraffin hydrocarbons; unsaturated hydrocarbons; halogen derivatives of the hydrocarbons; monohydric alcohols; sulfur and nitrogen derivatives of the alcohol radicals; aldehydes; glycols; and carboxylic acids.

"Pulp and Paper, Vol. I," by James P. Casey.

Published in 1952 by Interscience Publ., Inc., 250 Fifth Ave., New York 1, N.Y. 795 pages. Price $15.00

Approaching the study of papermaking from the standpoint of the colloid and physical chemist, this first volume in a series of two offers information on the fundamental chemistry of paper, its manufacture, and use. Chapters cover cellulose and hemicellulose; lignin; pulping; bleaching; fiber preparation; sheet formation; filling; sizing; wet strength; coloring; microbiology; and water. Tables, graphs, diagrams, and equations used in conjunction with the text help for a more complete understanding.

Flow meters—Information on both mechanical and electric type flow meters suitable for a wide variety of uses in industrial plants, utility companies, and process control work is offered in this 40-page bulletin (No. F1605). Each of the instruments for recording, integrating, indicating, automatic controlling, and telemetering the flow of steam, water, air, gas, oil, and other fluids are described in detail as to types of meter bodies, operating principles, primary devices for flow measurement, recording charts, and accessories. Many are illustrated with reproductions of the actual recording charts and sketches of typical methods of applying the instruments. *The Bristol Co., Waterbury 20, Conn.*

Rotary work feed table—Illustrated with photographs of actual machine installations, this 16-page bulletin describes in detail all parts of the company's two rotary work feed table models—the standard 22-in. and the standard 10-in. table top. Dimension drawings, specification data, sequence of operation, and the mechanical set-up for either manual or electrically-controlled performance are included for each. The booklet also offers wiring diagrams and electrical hookups for combining the feed tables with others in the company's line of pneumatic devices. *The Bellows Co., 222 West Market St., Akron, Ohio.*

Osaka trade index—Containing up-to-date information on approximately 1000 exporters, importers, and manufacturers in Osaka, Japan, this book provides an easy reference index for those having business dealings in this particular vicinity. The index is broken down into three sections—by commodity groups, by products and companies, and an alphabetical listing by companies. The address of each of the companies is given, together with the products it either imports, exports, or manufactures. Special features of the book are a reference list of business institutions related to foreign trade in Osaka and a Japanese-English vocabulary of company names and addresses used in the directory. *Osaka Foreign Trade Inst., (Osaka Boekikan), Hommachibashi, Osaka, Japan.*

Infra-red ovens—Shorter time cycle, compactness, and flexibility, plus easily controlled and instantly responding heat are the advantages of the company's infra-red ovens as presented in this 6-page brochure. Photographs illustrate the application of the ovens for drying or baking paint, degreasing, preheating,

HOW TO EXTEND YOUR PLASTICIZERS!

Use S/V SOVALOID C and Cut Plasticizer Bills 30 to 90%!

If you are using conventional plasticizers for Vinyl resins and Buna N, you can actually cut your costs 30 to 90% by extending these expensive plasticizers with S/V *Sovaloid C!*

S/V *Sovaloid C* costs but a fraction of ordinary, ester-type plasticizers—yet has many processing advantages. It is completely compatible with all Vinyl and Buna N compounds. It provides effective oil-resistant qualities . . . imparts flexibility . . . increases tensile strength . . . won't migrate from the finished product.

* * *

As an extender—or as a primary plasticizer—you can't beat S/V *Sovaloid C* for efficiency and economy! Ask your Socony-Vacuum Representative for full details.

Socony-Vacuum
Process Products

Process Products
SOCONY VACUUM

SOCONY-VACUUM OIL COMPANY, INC., 26 Broadway, New York 4, N. Y.
and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

etc., in a variety of industries, ranging from automotive and plastics to printing and silk screening. *The Fostoria Pressed Steel Corp., Fostoria, Ohio.*

Cyanoacetic acid—Because of the growing use of cyanoacetic acid, particularly as an intermediate, an expanded and revised 9-page technical data bulletin on the chemical has been issued. Complete properties and specifications are listed, together with suggested applications and references to published literature. *Kay-Fries Chemicals, Inc., 180 Madison Ave., New York 16, N. Y.*

Fabrics from Vinylite plastic film and sheeting—The story of Toscony fabrics, from the production of Vinylite film and sheeting through transformation into fabric, is told in this 24-page illustrated booklet. After detailing the process of creating the plastic film from salt, natural gas, coke, and limestone, the booklet offers information on the conversion into attractive fabrics by printing with Vinylite resin-base inks, by embossing, by laminating, and by the new process, Filmcelle, the three-dimensional surface effect. Included also is a summary of the merchandising, informative labeling, and export sales policies of the company. *Toscony Fabrics, Inc., 303 Fifth Ave., New York 16, N. Y.*

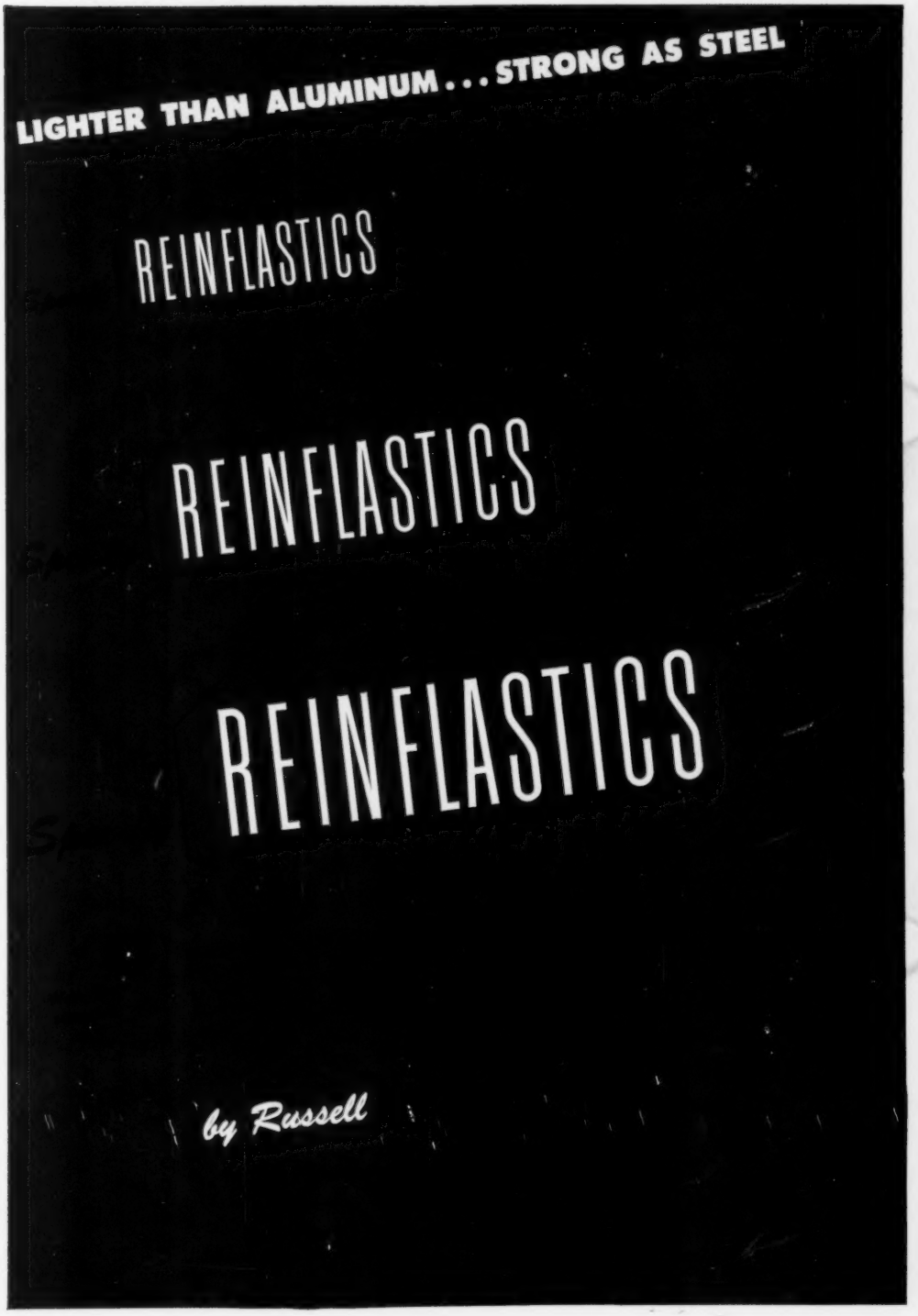
Plant operation and management—A survey of management and operating and production facilities, as well as a catalog of some of the items produced by this manufacturer of appliances and reinforced plastic products, are offered in this 23-page booklet, entitled, "A Look Behind The Scenes." Photographs and a short description accompany the list of products manufactured, including those for general consumption and those made for the government. Two divisions of the company, the Electro-Mechanical Div. and the Reinforced Plastics Div., are outlined as to operation and the machinery and equipment that are available in each. *Camfield Mfg. Co., Grand Haven, Mich.*

Air-operated butterfly valves—Butterfly valve bodies with diaphragm operators, available in a wide variety of styles, sizes, and materials to provide control of air, gases, liquids,

vapors, and semi-solids, are illustrated and described in the 12-page catalog. Complete specification data for the two basic types of bodies—standard pattern valves for control of low pressure, low velocity fluids, and heavy duty pattern for more severe service conditions—are given. A wide selection of diaphragm operators are illustrated with photographs and drawings and described as to construction, range, and operating characteristics. Also included are material specifications, mounting dimensions, maximum pressure ratings, and selection and ordering information. *Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44, Pa.*

Band tool manual—Machinists, students, engineers, purchasing agents, and production planning engineers can make use of this 160-page manual presenting the fundamentals of band tools. Tables of specifications, cross-sectioned diagrams, and illustrations of actual applications are given for each of the company's band tool types for sawing, slicing, grinding, filing, polishing, or special purposes. Chapters are included on band tool performances and the correct procedures for setting up. A special feature of the book is a series of tool selection charts embodying proper cutting recommendations for hundreds of materials ranging from aluminum to zinc. Basic tool terminology is also explained. The manual is available for $2.00 from *The DoAll Co., 254 North Laurel Ave., Des Plaines, Ill.*

S.P.I. directory—Intended as a handy reference to the companies composing The Society of the Plastics Industry, this 225-page directory also acts as a guide to company personnel and products. Professional members of the organization are also listed. The index is broken down into four divisions—by company name, by material, by machinery, and by product. Special features of the directory include a "Who's Who in S.P.I.," a breakdown as to the organization's committee setup, and an outline of the technical committee regulations of the society. Nonmembers may obtain copies for $4.50 from *The Society of the Plastics Industry, Inc., 67 West 44 St., New York, N. Y.*


LIGHTER THAN ALUMINUM . . . STRONG AS STEEL
REINFLASTICS
REINFLASTICS
REINFLASTICS
by Russell

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. 1951*	*Total sales 1951*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	16,371,613	15,149,076
0.003 gage and over	10,712,805	10,395,182
All other sheets, rods and tubes	5,831,862	5,323,028
Molding, extrusion materials	64,434,219	62,140,056
Nitrocellulose:		
Sheets	6,506,819	5,551,039
Rods and tubes	1,023,245	1,210,471
Other cellulose plastics[b]	11,936,803	10,704,678
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	75,226,238	50,403,530
Adhesive	63,266,947	39,103,521
Molding and casting materials[a]	238,276,167	205,712,868
Protective coatings (unmodified and modified except by rosin)	29,554,954	22,970,405
Miscellaneous uses	75,278,688	71,205,030
UREA AND MELAMINE RESINS:		
Adhesives	79,139,953	75,590,907
Textile-treating resins	26,765,183	24,249,008
Paper-treating resins	17,347,232	16,154,044
Protective coatings, modified and unmodified	25,086,317	17,974,458
Miscellaneous uses, including laminating and molding[c]	80,763,635	70,704,643
STYRENE RESINS:		
Molding materials[a]	270,142,828	246,395,650
Protective coatings, modified and unmodified	45,954,409	43,221,844
Miscellaneous uses	58,942,854	50,828,473
VINYL RESINS:[d] Total	464,511,974	401,843,862
Sheeting and film (resin content)[e]		161,510,944
Adhesives (resin content)		13,270,093
Textile and paper-treating resins (resin content)[f]		43,688,524
Molding and extrusion materials (resin content)		134,891,045
Protective coatings (resin content)		24,322,304
Miscellaneous uses (resin content)		24,125,952
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	171,033,852	168,414,902
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a, g]	82,506,818	72,158,479
Protective coatings[h]	19,061,429	21,141,442
All other uses[i]	99,609,885	94,488,294

* Dry basis unless otherwise specified. † Revised. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end-use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR NOVEMBER AND DECEMBER, 1951 by U. S. Tariff Commission

November 1951		December 1951	
Production	*Sales*	*Production*	*Sales*
922,940	686,967	1,507,128	872,332
526,911	531,420	560,304	414,930
263,149	270,184	458,262	300,909
3,382,285	3,467,748	2,894,498	2,721,847
433,774	382,805	406,527	347,083
74,360	102,887	60,277	90,834
796,283	523,979	507,069	382,498
5,312,360	2,957,883	4,897,856	2,850,481
3,479,891	3,005,456	2,481,360	2,520,421
21,189,020	16,122,773	17,000,161	12,551,313
2,595,198	2,055,271	1,939,734	1,698,097
5,877,972	5,648,108	4,591,103	3,975,345
4,937,750	5,163,083	4,916,760	5,081,821
2,488,431	2,300,929	2,955,605	3,058,136
1,735,794	1,239,147	1,340,077	1,624,776
1,434,129	1,143,729	1,600,562	1,094,837
5,181,275	4,003,527	3,748,480	3,319,550
23,832,259	19,451,875	21,405,003	14,295,434
4,419,499	4,032,620	4,209,763	3,470,638
4,787,621	4,184,631	5,061,982	4,610,443
40,596,421	31,170,397	42,028,641	27,242,945
	12,523,179		11,096,994
	948,335		713,649
	3,202,949		2,597,199
	10,453,335		9,402,658
	1,740,696		1,464,835
	2,301,903		1,967,610
14,850,410	14,414,491	13,868,920	12,890,692
7,039,186	6,985,774	7,947,157	6,473,944
1,625,641	1,800,299	2,298,892	1,914,947
7,880,596	7,736,274	7,222,168	6,484,364

tion are given. * Prior to January 1951, statistics were given on the basis of total weight. † Includes data for spreader and calendering-type resins. ‡ Includes data for acrylic, polyethylene, nylon, and others. § Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. ‖ Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

International Plastics News

British Industries Fair—The 1952 British Industries Fair will be held in London and Birmingham, England, May 5 to 16. Over 19,000 overseas visitors and 99,000 home buyers attended the 1951 fair, and 80,000 members of the general public were admitted at special hours. The 1952 Fair will again occupy three exhibit halls, Earl's Court and Olympia in London, and Castle Bromwich in Birmingham. Plastics will be on exhibition at Earl's Court.

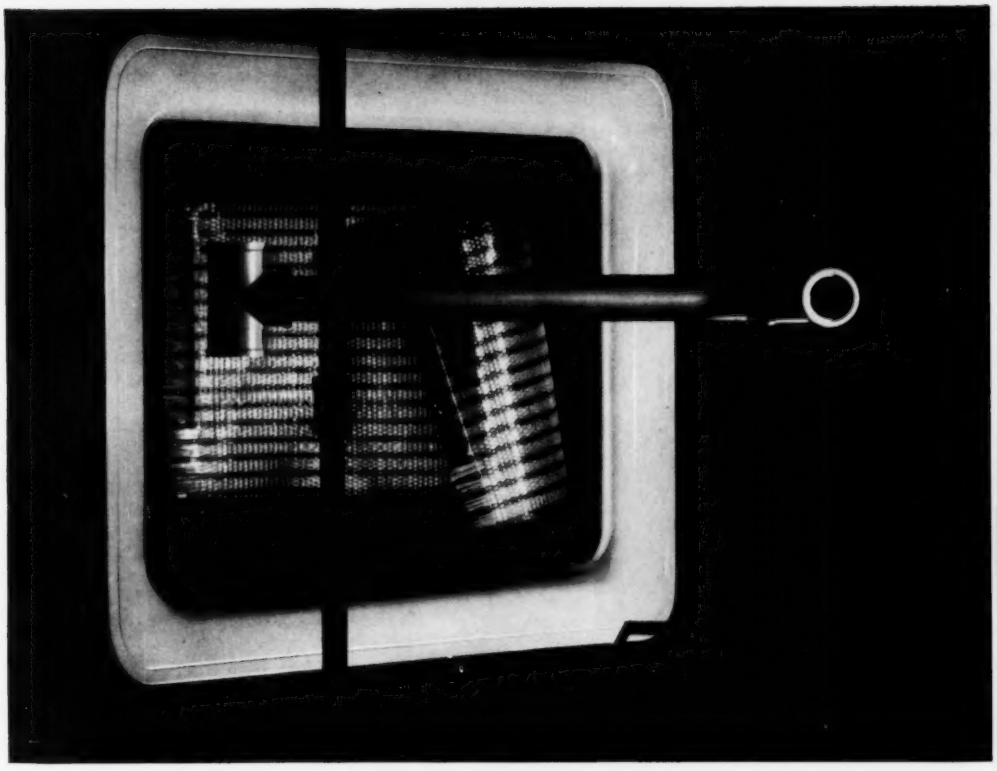
The Plastics Section will occupy 50% more floor space than it did in 1951. The diversion of material to the rearmament program and the consequent replacement of metals by plastics in many applications will give this section added significance. Exhibits will show how new molding techniques are broadening the field of plastics from small-wares to heavier goods which have hitherto necessitated the use of metal.

Among the items on exhibition will be a full-size delta-shaped aircraft wing molded with a no-pressure technique developed at the Royal Aircraft Establishment, Farnborough. The material used is asbestos fibers bonded together by resin. The molds are made of wood or plaster.

Moulded Components Ltd., Croydon, Surrey, will show a lightweight plastic material, Jabroc, claimed to be half as strong as steel but only one-fifth as heavy.

Hardura, Ltd., Great Harwood, Lancs., will show a plastic and felt material which is less expensive than linoleum but has better resistance to hard wear.

Resin plant in Israel — A complete line of synthetic resins for the paint, paper, printing ink, and plywood industries will be manufactured in Israel under the terms of an arrangement with Reichhold Chemicals, Inc., Detroit, Mich. Financial and operational control of the new Reichhold affiliate will remain in Israel, but engineers from the United States will go to Israel to impart the necessary know-how. Raw materials, such as petroleum products, glycerine, and vegetable oils, will be purchased in Israel.



THESE TOUGH NEW PLASTICS WANT TOUGH NEW JOBS

Outstanding shock resistance is the feature of new rubber-modified styrene plastics developed at Bakelite Company Laboratories. Shock resistance – plus excellent machining, chemical and electrical properties that fit them for many new, hard jobs!

These versatile new materials are offered at present in three grades. One grade has produced extruded gray pipe so tough that squeezing it nearly flat in a vise fails to crack it. At 0 deg. C., such pipe withstands a one-pound-ball drop test from nearly 80 inches. The same grade, extruded into rattan-like strips, provides economical woven chair seats of notable strength, flexibility, and beauty.

Another grade has provided black pipe that retains good impact strength even at sub-zero temperatures. A third, general purpose grade, offers the greatest moldability of the three types and is well suited to injection molding of large objects of thin cross-section. A white refrigerator door liner, for example, has passed prolonged slam tests. This grade also has been injection molded into colorful toy trucks and similar playthings that stand up under the mistreatment every Junior inflicts.

Impact strengths of these materials range from 1.0 to 10 foot pounds (Izod, per inch of notch) at room temperature. At minus 25 deg. C., the range is from 0.3 to 2.10 foot pounds.

Using conventional extrusion and molding equipment, these new materials offer promising economies and excellent performance wherever light weight, chemical resistance, good electrical qualities, color—plus high impact strength—are desired. Put them to work on your tough jobs. Write Dept. DS-13.

BAKELITE
TRADE-MARK
RUBBER-MODIFIED
STYRENE PLASTICS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

Changeable Signs

POINT-of-purchase promotion can make effective use of an illuminated sign formed from a sheet of translucent rigid vinyl which has a replaceable front panel of clear vinyl. Designed as a permanent display, the sign announces day-to-day price changes, special sales, and new items when the clear panel is removed and a new one substituted.

The complete sign is made by Dualite Displays, Inc., Cincinnati, Ohio. The vinyl panels are easy to wipe clean, and resist moisture, aging, warping, and most inorganic chemicals. The vinyl, supplied by Bakelite Co., has good dimensional stability which prevents shrinkage or expansion under wide changes in atmospheric humidity; thus the sign cannot become loose or drop out of the housing.

The large, fixed panel, which measures 8 in. by 24 in., is made of embossed translucent white vinyl, and is backlighted by a 20-watt fluorescent lamp inside the cabinet. Sculptured, three-dimensional shapes can be formed on this large panel.

Silhouette illustrations or lettering are screen processed in several colors on the smaller, interchangeable panels of clear vinyl that slide easily on or off the sign in metal grooves.

The lightweight sign can be hung from the wall and plugged in to the nearest electrical outlet.

Top: Clear vinyl panel can be replaced for change in promotional matter. Bottom: Fluorescent lamp lights display

Courtesy Bakelite Co.

Mildew destroyed this insulation

Milmer 1 controls mildew in vinyl products

Milmer 1 made this tubing mildew-resistant

Meet military specifications for vinyl film and vinyl-coated fabrics with the use of Monsanto Milmer 1 (Copper 8-quinolinolate). Dozens of military and government specifications for coated fabrics and vinyl film today require the incorporation of a fungistat. Milmer 1 meets the requirements of these specifications.

Sometimes effects of fungi are visible on products made from vinyls. At other times the fungi may not be visible but the plastic loses its flexibility and cracks. These ill effects are due to fungi eating away the plasticizer. Milmer 1 effectively controls fungi that cause deterioration of vinyls and vinyl coatings as illustrated in the pictures above.

Milmer 1 can be incorporated easily into the usual types of vinyl coating—calendered, plastisol, organisol and solvent. Properly applied, it will not cause crocking, bleeding or blooming, or cause production troubles on calender rolls. It is nontoxic and permanent.

If you would like information on military specifications on vinyls and vinyl-coated fabrics in which Milmer 1 can be used, or if you would like to know more about Milmer 1 in vinyls, contact or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Mo.

Milmer: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto Canada Limited, Montreal.

MILMER 1

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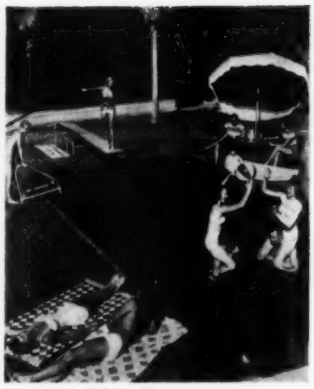
Vinyl Pool and Cabana



Photos courtesy Bakelite Co.

Vinyl swimming pool is permanent installation, resists moisture, chemicals

SWIMMING in your own backyard is the attractive offer made to home owners by complete bathing facilities made of vinyl sheeting—a full-size lawn swimming pool and a portable cabana. Success of both applications is due to the toughness and durability of the vinyl sheet, coupled with its resistance to moisture, salt water, sun lotions, temperature changes, and chemicals used in water purification. Bilnor Corp., Maspeth, N.Y., manufactures both items from vinyl supplied by Bakelite Co., New York, N.Y.

The swimming pool, designed for permanent installation, is made from specially compounded 20-gage sheet. Its base and walls are joined by electronically welded seams and form a liner which fits snugly into an excavation below ground level. Wooden pins driven into the ground at each corner support and anchor the liner. Sandy or loamy excavations may have to be reinforced.

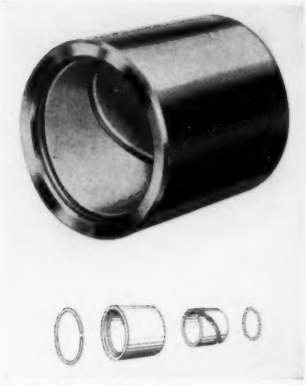
While the liner by itself is a complete and usable swimming installation, the manufacturer also supplies an inflatable bumper and a pool cover as optional equipment. The bumper is fastened around the top of the liner to prevent water from splashing beyond the pool area; the cover, fabricated from 8-gage vinyl, is secured by slipping metal pins into the side seams of the liner.

The standard size pool—27 ft. long, 13 ft. wide, with a graduated depth of from 3 to 5 ft. and a water capacity of more than 10,000 gal.—can accommodate 15 people with ease. Drainage is accomplished either with a built-in drain and pipe outlet system or with a sump pump; Bilnor manufactures the pool for either method of drainage. Total weight of the liner, bumper, and cover is less than 200 lb., 120 lb. of which represents the weight of the liner alone.

Companion piece to the pool is the portable cabana, a convenient dressing room that the manufacturer calls the "Cabanor." Floor of the cabana is an 8-ft., hexagonal sheet of vinyl fastened on each side to an inflatable base. Each of the six sides of the base are separately inflated, and the six anchoring points provide added stability. The side panels are attached to the base and taper up to the top of a 9-ft.-high sectional center pole. Alternate panels in the six sides have ventilation openings. All seams in the cabana are electronically welded, as is also a 7-ft. vinyl slide fastener, which can be closed from either the outside or inside.

The cabana weighs about 14 lb. and folds up into a small package so that it can be easily set up for lawn bathing, or taken to the seashore, and then conveniently stored. It also doubles as a shelter for outdoor hunting and fishing trips and as a children's playhouse.

Cabana made of 20-gage vinyl sheet folds up into small portable package



Courtesy Thomson Industries, Inc.

Nylon liners for bearing (top) are secured in place with snap rings (below)

Nylon Liners

BEARING liners that utilize the excellent properties of nylon as a bearing material yet circumvent the limitations that have heretofore restricted its use have been developed by Thomson Industries, Inc., Manhasset, N. Y.

As a bearing material, nylon performs well under adverse lubricating conditions, or with no lubricant at all; it is tough and resistant to abrasion; it can withstand temperatures over 250° F.; it has a low coefficient of friction; and it remains unaffected by most ordinary industrial chemicals. But all-nylon bearings are subject to dimensional changes caused by thermal expansion and moisture absorption, and bore distortion caused by stress deformation.

Construction of the new Nylined bearing overcomes these limitations. An outer sleeve of inexpensive metal is lined with a sheet of Du Pont nylon 0.030 in. thick. One operation on a punch press blanks out the sheet and feeds the lining into the sleeve. Both ends of the liner are secured to the metal sleeve with snap rings; the body of the liner is free to expand and contract circumferentially inside the sleeve.

Inside diameters of the Nylined bearings range from ¼ in. to 4 inches. Some of the industrial uses to which they are put are in various types of pumps; electrical equipment; packaging, paper, and drilling machinery; transmissions; conveyor rolls; and pneumatic tools.

'O' Rings

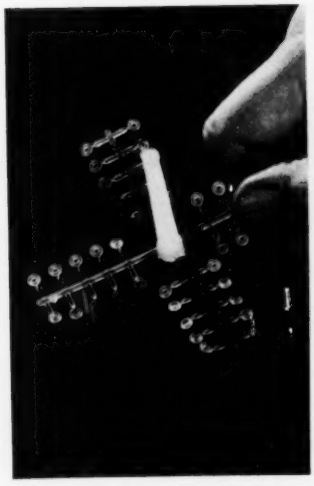
ONE of the smallest molded polyethylene applications reported to date is an "O" ring produced by Grebar, Inc., New York, N.Y., for use in military time fuses. Each ring, which is injection molded in the shape of a tiny doughnut, weighs 0.0205 grams. Its inside diameter is 0.055 in., held to a tolerance of ±0.005; its outside diameter measures 0.179 in., held to a tolerance of ±0.006; and its wall thickness measures only 0.062 in., held to a tolerance of ±0.003 inches.

40-Cavity Mold

Forty such rings are produced at one time in a 40-cavity mold which is run on a 4-oz. MacRay injection machine. The polyethylene flows into each cavity through a very small gate. After the molding operation, an operator breaks off the pieces from the gates; a trimming die was not found to be practical for a shot with so many units.

An interesting point in the molding of such small parts is that, for highest efficiency, the weight of the entire shot is more than 4½ times that of the combined weight of the 40 parts produced by that one shot. The complete shot weighs 3.82 g., of which total 3 g. is the combined weight of the sprue, the runners, and the secondary runners.

Polyethylene "O" rings, each weighing 0.0205 grams, are molded in a 40-cavity MacRay injection machine



Gloves

TWO vinyl coated work gloves, both offering protection against water, concentrations of all acids, alkalies, oils, and a variety of corrosive chemicals, have been independently marketed by Houghton Laboratories, Inc., Olean, N. Y., and Mine Safety Appliances Co., Braddock and Thomas Sts., Pittsburgh, Pa.

The Houghton product, called Hyflex Gloves, are canvas gloves coated with a tough, abrasion-resistant vinyl plastisol which the manufacturer compounds for the purpose. Coating is done by a newly developed centrifugal process which involves rotating the gloves at various speeds after they have been coated. This results in an evenly applied plastisol coating with good adhesion and which is free of runs and pinholes.

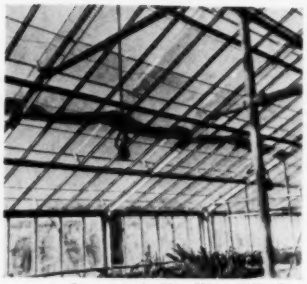
Hyflex gloves retain their original flexibility when subjected to temperatures ranging from −10° to as high as 200° F.

The M.S.A. all-purpose work gloves are also vinyl-treated canvas and are reported to shed moisture and resist chemicals more efficiently than rubber gloves. The vinyl coating remains flexible in extreme cold, does not become tacky at high temperatures, and is recommended for protection against strong acid concentrations, including sulfuric acid, oleum, and all caustics.

Both gloves are suggested for farm and industrial work, including electroplating, asphalt manufacturing, chemical processing, construction, and oil refining.

Vinyl coated work gloves will effectively resist various corrosive chemicals

Courtesy Houghton Labs, Inc.



Courtesy Lumite Div., Chicopee Mfg. Corp.

Saran shade cloth on roof controls amount of light entering greenhouse

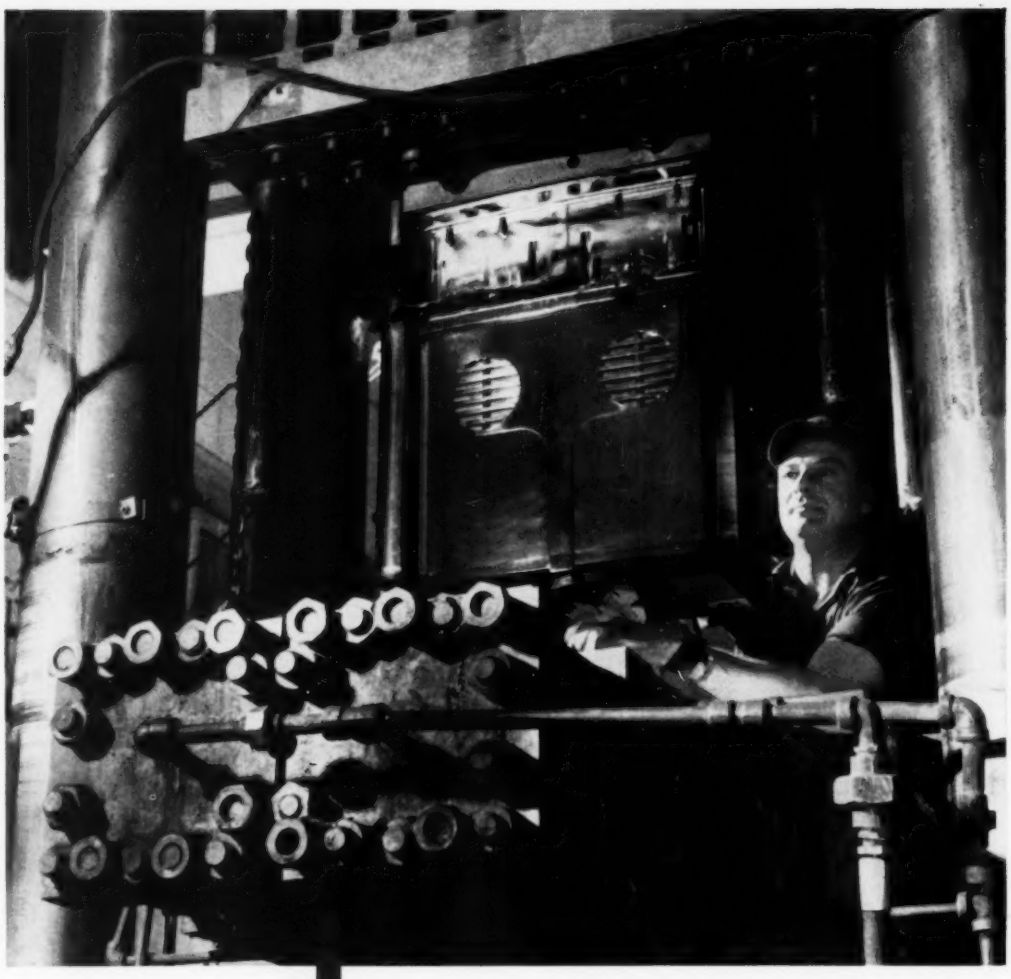
Greenhouse Screen

ORCHID growing experiments conducted at the Horticulture Laboratories of Rutgers University, New Brunswick, N.J., reveal that when Lumite shade cloth is used to control the amount of light entering a greenhouse, the number of fertilized orchids grown can be increased by 300 percent. The tests were begun two years ago under Dr. O. Wesley Davidson to sudy factors controlling light, heat, humidity, and fertilizer in orchid growing.

As part of the experiment in light control, Lumite shade cloth measuring 25 ft. long and 33 ft. wide was placed on the roof of the greenhouse, replacing a lath shade made of hard-grained cypress. One edge of the cloth was attached to an aluminum pipe 1½ in. in diameter which was mounted on an aluminum frame so the cloth could be rolled up or down during the day to control the amount of light entering the greenhouse. When the shade cloth was rolled down, the mesh reduced light intensity by 55 percent.

The shade cloth was supplied by Lumite Div., Chicopee Mfg. Corp., New York, N.Y. Lumite cloth is semi-permanent, with a known life of 12 yr., and needs no maintenance.

Dr. Davidson made the following statement on results: "My experiments show that Lumite shade cloth permits the plants to get the necessary light without burning. Started from small plants, these orchids grew quicker, with better texture, stronger stems, and therefore lasted longer. Some orchids can now be flowered in 3½ to 4 years, instead of 5 to 7 years, because of combined light control and nutrient."



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EXTRUSION MACHINES. Brochure traces history of company and gives details on Davis-Standard extruders for the plastics and rubber industry. The Standard Machinery Co. **(D-201)**

VINYL PLASTIGELS. Booklet contains data on the preparation, properties, and uses of new "Vinylite" dispersion resins known as plastigels, which can be processed at room temperature with low pressures. Bakelite Co., Div. Union Carbide and Carbon Corp. **(D-202)**

COLD HEADED FASTENERS. Folder explains cost and production advantages of cold headed fasteners over machined fasteners. Gives helpful hints for specifying. Continental Screw Co. **(D-203)**

WET PROCESS TUMBLING BARRELS. Bulletin illustrates, describes, and gives features of Tumb-l-Matic Type XL tumbling barrels for wet ashing of plastics and for deburring and cutting down small metal parts. Tumb-L-Matic, Inc. **(D-204)**

VINYL ACETATE POLYMERS AND COPOLYMERS. Folder describes various polyvinyl acetate emulsions, solutions, and copolymer materials which are available on a custom compounded basis for heat-seal, solvent reactive, decorative and other coatings, and for use as adhesives. National Starch Products Inc. **(D-205)**

PEARL FINISHES. Magazine reprint explains techniques of using natural and synthetic pearl lacquer finishes on simulated pearls. The Mearl Corp. **(D-206)**

GAS WELDING OF PLASTICS. Reprint from MODERN PLASTICS explains the techniques and know-how for welding sheet plastic materials with either hot gas or electric welding torches. American Agile Corp. **(D-207)**

MATCHED MOLDING OF REINFORCED LAMINATES. Folder gives details on mold design and on methods of successful molding of resin-reinforced glass pieces of large sizes. Marco Chemicals, Inc. **(D-208)**

"PLIOVIC AO" ORGANOSOLS. Techni-Guide tells about compounding and processing "Pliovic AO" organosols. Gives details on plasticizers, solvents, fillers, coloring, and formulations. Goodyear Tire & Rubber Co., Inc. **(D-209)**

RADIANT HEAT APPLICATION. Application report gives details on methods used to provide intense, zoned infra-red heating for controlled rapid curing of a sprayed-on synthetic enamel. Edwin L. Wiegand Co. **(D-210)**

"LESTER PRESS." Latest issue of this house organ contains newsy notes of interest to owners of Lester injection molding presses and to owners of other injection molding presses, as well. Lester-Phoenix Inc. **(D-211)**

BONDING RUBBER TO METAL. Collection of papers contains data on "Ardux" bonding resins and on techniques used to develop successful bonds between metal and plastics to natural or synthetic rubbers. Ciba Co., Inc. **(D-212)**

VISCOMETERS. List shows typical customers in all fields who have purchased Brookfield Viscometers. Brookfield Engineering Laboratories, Inc. **(D-213)**

ON-THE-PRODUCT LABELS. Folder summarizes and explains the advantages of "Mystik Self-Stik" labels for affixing identification of brands, instructions, and other data to plastic products. Chicago Show Printing Co. **(D-214)**

MOLDING FACILITIES. Injection and compression machines, mold making facilities and typical products manufactured are enumerated in a folder issued by Plastimold Corp. **(D-215)**

DIE HOBBING. Reprint from MODERN PLASTICS gives the origin of hobbing and the procedures and advantages attached to the use of this process of making molds for plastics. Newark Die Co. **(D-216)**

VERTICAL INJECTION MACHINE. Specification sheet on the Watson-Stillman 2-oz. vertical injection molding machine for laboratory testing, research, and product development. Watson-Stillman Co. **(D-217)**

PLASTIC TUBINGS AND FITTINGS. Price lists on "Mills Plastic" flexible pipe, tubing, fittings, and nipples. Elmer E. Mills Corp. **(D-218)**

DIE CUTTING PRESS. Descriptive folder on the Hobbs Tri-Power Press to provide power for use for all die cutting requirements. Hobbs Mfg. Co. **(D-219)**

THREADED MOLD CORES. House organ contains feature article on simplified rack and pinion construction for use in molds with threaded cores. Detroit Mold Engineering Co. **(D-220)**

LAMINATED "INSUROK." Catalog insert describes the properties, physical characteristics, and features of a cotton fiber mat base phenolic laminate for mechanical applications needing uniform strength in all directions. The Richardson Co. **(D-221)**

REDS AND YELLOWS FOR PLASTIC MATERIALS. Folder gives complete details, with color chips, on "Cadmolith" cadmium red and yellow lithopane colors for plastic materials. The Glidden Co. **(D-222)**

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"LUCOFLEX" RIGID POLYVINYL CHLORIDE. Booklet explains how the superior mechanical, electrical, and chemically resistant characteristics of "Lucoflex" rigid vinyl suit it to a wide range of industrial applications. Data on fabrication. American Lucoflex, Inc. **(D-223)**

INJECTION MOLDING MACHINES AND MOLDS. Detailed specifications on PECO 2-, 4-, 6-, 8-, and 16-oz. injection molding machines and the mold building facilities of the Projectile & Engineering Co. Ltd. **(D-224)**

SEALING CORRUGATED BOXES. Discussion of the methods for sealing corrugated shipping boxes with tape, glue, metal staples, straps, and wires. Contains many helpful ideas. The Hinde & Dauch Paper Co. **(D-225)**

PLASTIC MILLS. Catalog contains illustrations, features, and descriptions of the line of rubber and plastic mills manufactured by Erie Engine & Mfg. Co. **(D-226)**

"BOLTARON" MOLDING MATERIAL. Leaflet explains the characteristics of "Boltaron," a thermosetting material of almost unlimited formability and high impact resistance. Bolta Products Sales Inc. **(D-227)**

MOLDS AND DIES. The services offered by The Parker Stamp Works in the manufacture of all types of plastic molds and die casting dies are covered in this folder. The Parker Stamp Works, Inc. **(D-228)**

UTILITY ENGRAVER. Booklet on the "Panto" heavy-duty bench-type engraver for engraving plastics, metal, etc. Contains type samples and illustrations of supplementary equipment. H. P. Preis Engraving Machine Co. **(D-229)**

MULTI-PURPOSE EXTRUDER. The compounding, extruding, coloring, and scrap reclaiming functions of the Windsor twin-screw extruder are explained in this bulletin. Specifications are included. R. H. Windsor Ltd. **(D-230)**

HANDLING ROLLS. The Kohler system of roll handling is described in a bulletin issued by the Dilts Machine Works, Div. of The Black-Clawson Co. **(D-231)**

COATING AND HANDLING EQUIPMENT. Continuous operation machines for coating and processing web materials such as papers, textiles, films, and foils are discussed in an illustrated brochure issued by Industrial Ovens, Inc. **(D-232)**

STEELS FOR PLASTIC MOLDING. Booklet, "Tooling Up For Plastics," is a practical guide to the selection, application, and heat treatment of Carpenter steels. Contains tips on plastic tooling, selection of mold steels, and data on tool steels for hobs. The Carpenter Steel Co. **(D-233)**

CUT-OFF ATTACHMENT. Provided are specifications, and a discussion of the features of the B & D automatic cut-off attachment for extruding-machine conveyors. Barker-Davis Machine Co. Inc. **(D-234)**

PROCESSING EQUIPMENT. Data on a line of equipment of interest to plastics manufacturers. Includes crushers, mills, dry batch mixers, batch blenders, air separators, and vibrating screens. Sturtevant Mill Co. **(D-235)**

LABELING IDEAS. Brochure contains hundreds of suggestions on sizes and styles of labels for packaging and shipping. Ever Ready Label Corp. **(D-236)**

"STAFLEX KA." Description of a plasticizer which is designed to incorporate some of the advantages of the high-molecular-weight polymerics without their disadvantages. Deecy Products Co. **(D-237)**

MOLD AND DIE MAKING EQUIPMENT. Booklet contains information about die-sinking and engraving machines designed and built to meet the needs of modern mold and tool work. Complete specifications and descriptions. Price list included. J. Arthur Deakin and Son. **(D-238)**

MARKING. Broadside featuring questions and answers about the Peerless process of roll leaf stamping. Illustrates and describes various types of presses used for this process. Peerless Roll Leaf Co., Inc. **(D-239)**

FORMICA FOR INDUSTRIAL APPLICATIONS. Booklet explains various electrical, chemical, and mechanical applications of Formica laminated plastics. Explains how grades are engineered to meet specific requirements. The Formica Co. **(D-240)**

INJECTION MOLDING EQUIPMENT. Explanatory folder and detailed specification sheets on the 3-, 8-, and 12-oz. Fellows-Leominster injection molding machines manufactured by The Fellows Gear Shaper Co. **(D-241)**

COLORING CELLULOSE ACETATE. Folder points out the advantages of having the individual molder color his own cellulose acetate and cellulose acetate butyrate and explains the techniques for obtaining good dispersion. Ferro Corp. **(D-242)**

INJECTION PRESS. Illustrated bulletin describes the Van Dorn Model H-200, 2-oz. semi-automatic injection press. Specifications are given. The Van Dorn Iron Works Co. **(D-243)**

CONTINUOUS ROLL FEEDS. Bulletin describes a machine for maintaining full speed production on all roll fed machines while new rolls are sewed on. Mount Hope Machinery Co. **(D-244)**

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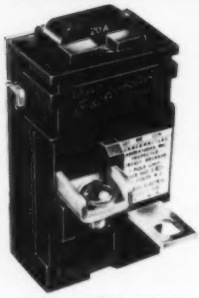

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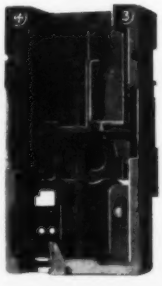

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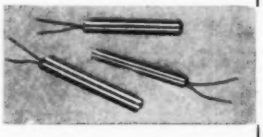

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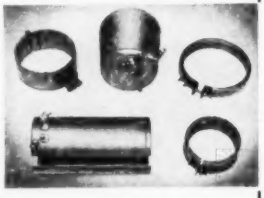

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S.P.I. Session on Reinforced Plastics

THE Seventh Annual Technical Session and Exhibit of the S.P.I. Reinforced Plastics Div. will be held at the Edgewater Beach Hotel, Chicago, April 9 through 11. This year the exhibit is designed for customers of the industry as well as for technical men.

Registrants at the conference will receive the complete proceedings of the sessions, including questions and answers as well as the papers delivered. The proceedings will be mailed out after the close of the conference.

A condensed program for the conference follows:

Wednesday, April 9

10:00 a.m.—Session

Presiding: Harold B. Freeman, American Cyanamid Co.

"S.P.I. Reinforced Standards Report," by Arthur L. Smith, Continental Can Co., Inc.

"A Progress Report of the Accomplishments of the Reinforced Plastics Division Preparedness Committee," by Joseph S. Finger, Corrulux Corp.

"A Progress Report of the Cooperative Effort Between Fort Belvoir and S.P.I.," by Leonard S. Meyer, Western Products, Inc.

"An Evaluation of Several Classes of Fillers for Reinforced Plastics," by Louis Linzmeyer, East Coast Aeronautics, Inc.

"Automatic and Hand Preforming," by A. W. Levenhagen, Molded Resin Fiber Co., and W. Brandt Goldsworthy, Industrial Plastics Corp.

12:30 p. m.—Luncheon

Moderator: Louis L. Potomac, Alsynite Co. of America.

"New Developments in the Field of Resins." Panel: H. M. Day, American Cyanamid Co.; J. V. Miller, Atlas Powder Co.; Frank Bennett, Bakelite Co.; John R. Charlton, Ciba Co., Inc.; S. A. Moore, Interchemical Corp., Finishes Div.; James J. Coleman, Marco Chemicals, Inc.; Dr. Paul M. Elliott, Naugatuck Chemical Div., U. S. Rubber Co.; Dr. E. W. Moffett, Pittsburgh Plate Glass Co.; M. H. Bigelow, Plaskon Div., Libbey-Owens-Ford Glass Co.; H. Kline, Reichhold Chemicals, Inc.; William E. Wirsch, Resinous Products Div., Rohm & Haas Co.; J. E. Carey, Shell Chemical Corp.

8:00 p.m.—Open Meeting—

"Standards on Reinforced Plastics."

Thursday, April 10

9:30 a.m.—Forum

"A Review of the Armed Service Agencies Reinforced Plastics Developments and Problems." Moderator: Dr. Russell W. Ehlers, Chemicals and Plastics Branch, Research and Development Div., Office of the Quartermaster General.

"Materials Availability and Conservation," by William Y. Webb, Munitions Board.

"Reinforced Plastics in Naval Aircraft," by Robert Temple, Bureau of Aeronautics, Department of the Navy.

"Effects of Humidity During Fabrication on the Physical Properties of Glass-Fabric-Polyester Laminates," by J. E. Wiet, National Bureau of Standards.

"Plastics in Aircraft," by Captain D. Rosato, Wright Air Development Center, Wright-Patterson Air Force Base.

"Progress in Reinforced Plastics at the Engineer Research and Development Laboratories," by George W. Howard, Engineer Research and Development Laboratories, the Engineer Center and Fort Belvoir.

"Reinforced Plastic Tubing for Naval Ordnance," by F. R. Barnet and H. B. Atkinson, Jr., U. S. Naval Ordnance Laboratory.

"A 36-Foot Plastic Landing Craft." Speaker being appointed by Bureau of Ships, Department of the Navy.

12:30 p.m.—Luncheon

Presiding: Ralph Perkins, Jr., Owens-Corning Fiberglas Corp.

"The Repair and Maintenance of Reinforced Plastics Parts," by Samuel S. Oleesky, Reinforced Plastic Consultants & Engineers.

"Surface Treatment for Glass Fibers," by John Bjorksten, Bjorksten Research Laboratories; Robert Steinman, Garan Chemical Corp.; J. P. Plummer, Glass Fibers, Inc.; Dr. M. H. Jellinek, Linde Air Products Co., Div. Union Carbide & Carbon Corp.; L. P. Biefeld and T. E. Philipps, Owens-Corning Fiberglas Corp.; Captain D. Rosato, Wright Air Development Center; Wright-Patterson Air Force Base.

6:00 p.m.—Social Hour

7:30 p.m.—Annual Banquet

Toastmaster: Leonard S. Meyer, Western Products, Inc., Principal Speaker: Cameron Ralston, "The Five Plagues of Democracy."

Friday, April 11

9:00 a.m.—Session

Presiding: Joseph L. Rodgers, National Production Authority.

"Mechanical Properties of a 'Dog-Bone' Core Sandwich Panel," by Dr. Albert G. H. Dietz, Massachusetts Institute of Technology.

"The Control of Gel and Cure of Polyester Resins at Room Temperature," by H. M. Day, American Cyanamid Co.

"Survey of Developments in Equipment for Press Molding Extra-Large Reinforced Plastics Pieces." Introduction: Hiram McCann, MODERN PLASTICS. Moderator: W. Burdette Wilkins, Consultant.

Panel discussion: Robert J. Brinkema, R. J. Brinkema Co.; M. C. Tribett, The French Oil Mill Machinery Co.; Douglas Hastings, Hannifin Corp.; Russell W. Powell, The Hydraulic Press Mfg. Co.; Johan A. Muller, Lewis Welding & Engineering Corp.; L. Wheeler, Turner Machine Co.; L. C. Williams, L. C. Williams and Associates.

12:30 p.m.—Luncheon

Presiding: Milton Brucker, Zenith Plastics Co.

"A Look at the Future of Reinforced Plastics," by Games Slayter, Owens-Corning Fiberglas Corp.

2:30 p. m.—Technical Forum

Moderator: Robert J. Brinkema, R. J. Brinkema Co.

Panel: H. M. Day, American Cyanamid Co.; Harold Freeman, American Cyanamid Co.; Frank Bennett, Bakelite Co.; Arthur L. Smith, Continental Can Co., Inc.; Dr. Russell W. Ehlers, Department of the Army; Louis Linzmeyer, East Coast Aeronautics, Inc.; Roger B. White, Glastic Corp., Inc.; W. Brandt Goldsworthy, Industrial Plastics Corp.; Dr. A. G. H. Dietz, Massachusetts Institute of Technology; A. W. Levenhagen, Molded Resin Fiber Co.; Clare E. Bacon, Owens-Corning Fiberglas Corp.; Leonard S. Meyer, Western Products, Inc.; Milton Brucker, Zenith Plastics Co.

By title only: "Promoters and Accelerators, Their Effect on the Cure Characteristics of Polyester Resins." Co-authors: Samuel A. Moore and Arthur Weber, Interchemical Corp., Finishes Div.

Acetate

(*Continued from p. 95*)

piece. A double pin-point gate is used on the top of the housing.

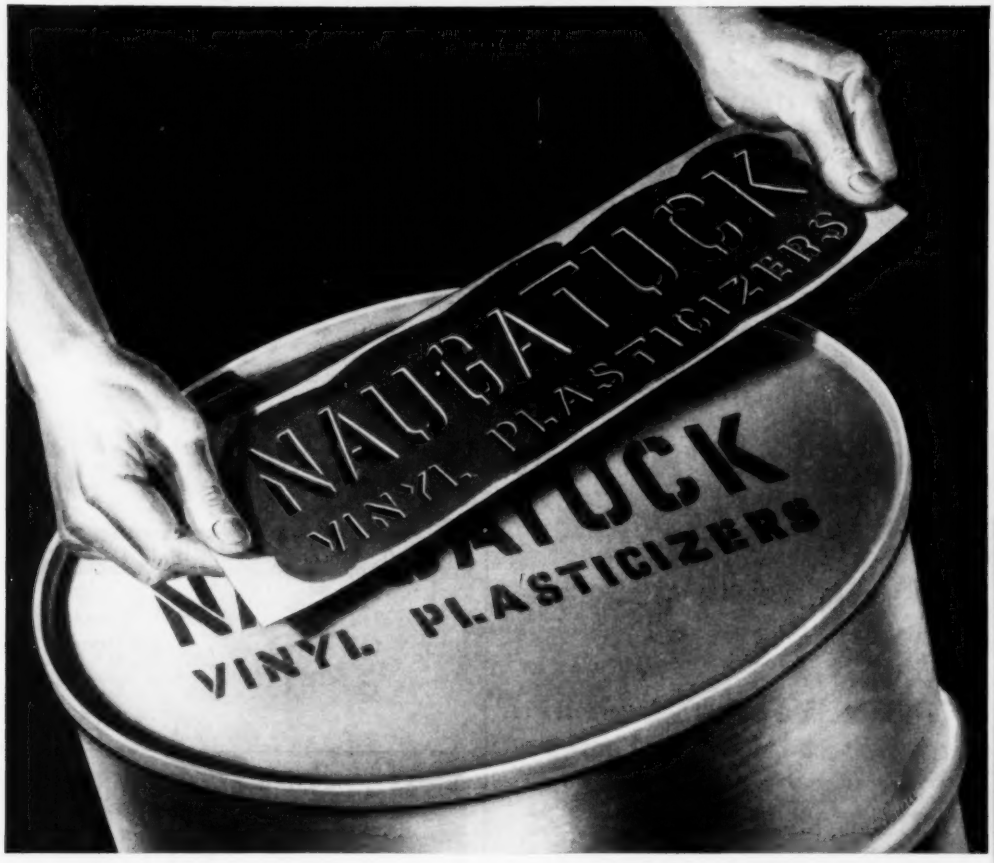
In changing over from the XF material to the present acetate formulation, certain construction changes were necessary in the polisher so that Underwriters' approval could be retained. These consisted primarily of metal shielding applied to some of the electrical components.

Nylon Gears

A combination of molding and hobbing is used to produce the nylon gears which power the revolving brush at the bottom of the polisher. Chicago Die Mold, which molds the gear blanks, also does some machining operations on these parts. Shafts are then inserted in the blanks and the teeth are cut on regular gear hobbing equipment. This procedure is followed because of the fine pitch tolerances involved and the stiff restrictions on out-of-round eccentricity. The nylon gears are much quieter in operation than metal gears and require no lubrication, eliminating the need for a gear case and lowering production costs.

There are four gears, all of which are hobbed from injection molded natural nylon blanks. Two of them are spur gears and two of the helical type. The larger gears, slightly more than 3 in. in diameter, are of composite construction, with nylon outer rings supported between metal castings and stampings which contain the shaft bearings. As shown in the accompanying parts photograph, one of these nylon pieces has several cored holes through which the assembly is riveted. The smaller pinion gears measure slightly under 1 in. in diameter.

The 8-in. rotary brush of the Super 8 is connected to the motor by means of a clutch which protects the motor against overloading and overheating. No power is transferred from motor to brush until the motor is turning at 2600 r.p.m. Each polisher comes equipped with a special brush for scrubbing, a softer brush with more flexible bristles for polishing, and a fluffy chenille pad to impart a high luster after polishing. Brushes are held in place by a simple spring device, making them quickly interchangeable.—END



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Silicone-Glass

(*Continued from p. 106*)

mended catalyst, Dow Corning XY-5, is especially adapted for use with 2104, and is furnished with each order of the resin. The resin is supplied in a 60% solution of toluene (which is driven off during the coating and precuring process), and the amount of catalyst to be added—which is very critical and may differ from shipment to shipment—is specified by the resin supplier in a letter which precedes delivery of the resin.

The amount of catalyst to be used is recommended on the basis of a 40% pick-up of resin solids on the weight of the fabric, and a 5-min. precure at 110° C., using style 181 heat cleaned glass fabric. It is also recommended that the laminator himself, if he is doing his own coating, make small trial tests as well on each lot of resin.

Vertical Coating Tower

The system used by U.S. Polymeric Chemicals in its vertical treater is to add the catalyst to the resin in toluene solution, then add more toluene before the cloth impregnation. By the speedy removal of the solvent in the coating tower, the resin can be advanced to the desired precure stage. The coaters have found that anything that will affect the alkalinity of the resin solution tends to cause an over-advanced laminating stock, whereas acidic contaminates poison the catalyst; thus the greatest of care must be exercized to insure clean equipment.

After impregnation, after precure, and on cooling, the stock is flexible with practically no tack. Advantage may be taken of the flexibility to preform the stock by warming it to approximately 80° C. and stretching it over a cold mold to obtain desired shapes before molding.

The finished coated stock may be laminated similarly to other conventional low-pressure resins such as the polyesters, but it has been found desirable to "breathe" the laminate some time during the closed press cycle. It has also been found well to allow the lay-up to heat up to a press temperature of 175° C. under contact pressure, before starting the closure.

In positive molding or bag molding,

it has been found satisfactory to place the lay-up in the mold and close immediately, maintaining the desired pressure during the entire curing cycle. In vacuum molding, it is not necessary to "bump" the laminate, because the vacuum withdraws excess volatiles during cure of the resin.

Cure and After-Cure

Time of press cure is dependent upon the thickness of the laminate, a 15-min. cure being recommended for ⅛-in. laminates and a 30-min. cure for ¼- or ½-in. laminates; parts thicker than ½ in. and up to 2 in. should be cured for an hour. All laminates should be cooled to below 100° C. before removal of pressure. In order to obtain the highest heat resistance, the silicone low pressure laminates should be given an additional cure in an oven after they are removed from the press. The following after-cure schedule is recommended: 16 hr. at 90° C.; 1 hr. at 125° C.; 1 hr. at 150° C.; 1 hr. at 175° C.; 1 hr. at 215° C.; and from 80 to 150 hr. at 250° C. At no time during the after-cure should the laminates be allowed to cool off.

Recommended parting agent for molding is Cellophane 600 APC. Recommended release agent is Dow Corning XEC135A. Standard silicone release agents have been found unsatisfactory since they affect the laminate surface.

Main advantage of silicone laminates, made by either high or low pressure, is the maintenance of strength after long aging at high temperatures. To the present time, tests indicate that no additional deterioration of silicone laminates occurs up to 500° F. for 200 hr. of aging. Tests also indicate that there is a possible usage of silicone laminates for short time exposure up to 900° F.

The chart on page 106 gives comparisons between low pressure laminate made of glass cloth bonded with Dow Corning 2104 resin, and other electrical grade and heat resistant laminates.

Acknowledgements

The editors are indebted to William Thornhill, vice president, U. S. Polymeric Chemicals, Inc., and to R. E. Bright and K. R. Hoffman, Dow Corning Corp., for their assistance in the preparation of this article.—END

Cellulose Esters

(*Continued from pp.* 127-36)

down in the layer milled from the 0.050-in.-thick piece may be the result of additional thermal breakdown by milling a material already considerably photodegraded (see Table XIII).

When a similar plastic composition containing 1% of phenyl salicylate was sealed in air in a quartz tube and exposed to Weather-ometer radiation, the breakdown rate was sharply reduced from that observed in the same sample exposed outside the tube. The former sample showed only a 14% decrease in molecular weight after 800 hr. of exposure, whereas the latter lost 46%, probably because of the greater loss of phenyl salicylate.

It is perhaps not generally realized that the best inhibitor for a plastic article of substantial thickness may not be the best for a thin sheet. In the latter case, it may be better to sacrifice some initial efficiency in the inhibitor for the sake of a gain in its permanence.

Phenyl salicylate appears to function primarily as an inert inner filter for the ultra-violet light, according to studies made by Morey and Tichenor (23). In Table XVI is shown the agreement they obtained between observed and calculated rates of breakdown, under a General Electric S-4 lamp, of plastic samples containing various concentrations of phenyl salicylate. These experiments were made on 0.010-in.-thick films of cellulose acetate butyrate plasticized with 10% of triphenyl phosphate. In the calculations, a uniform quantum yield of breakdown was assumed for wavelengths below 3500 A.

As Table VII indicated, phenyl salicylate shows much less antioxidant activity than its isomer, resorcinol monobenzoate. This may be an important factor in determining the superiority of the latter as a weathering inhibitor (24). The primary requirement for a good inhibitor, however, is that it have the proper molecular make-up for absorbing ultra-violet energy and disposing of this absorbed energy in a harmless manner. Many efficient antioxidants do not fulfill this condition and are of little use by themselves as weathering inhibitors. Resorcinol monobenzoate combines both absorbing and antioxidant functions to a marked degree.

Table XVI.—Ultra-Violet Filter Action of Phenyl Salicylate in Cellulose Acetate Butyrate Plastic

Phenyl Salicylate	*Relative Degradation Rate*	
	Calc.	*Obs.*
%		
0.00	100	100
0.01	92	86
0.03	78	78
0.1	49	55
0.3	25	27
1.0	11	11

Value of Antioxidant in Pigmented Plastic—We found that the addition of an antioxidant can be particularly valuable for increasing the resistance of certain pigmented plastic formulations toward accelerated weathering. For example, when titanium dioxide was the pigment used, almost any antioxidant was highly effective in preventing the breakdown that otherwise occurred at depths within the plastic not directly reached by the actinic light. The photosensitization of oxidation reactions by titanium dioxide has been discussed by Weyl and Forland (25). Table XVII gives some illustrative examples of this protection in cellulose acetate butyrate containing 12 parts of dibutyl sebacate and 2 parts of pigment. In each case, 1% of antioxidant was used. In this formulation, phenyl salicylate gave no added protection. By contrast, in the unpigmented plastic, phenyl salicylate gave better protection than *p-tert*-butylphenol and very much better protection than the "hindered" phenol.

Table XVII.—Protective Action of Antioxidants in Cellulose Acetate Butyrate Plastic Pigmented with Titanium Dioxide[a]

Antioxidant	*Time in Weather-Ometer Required for 25% Loss of:*	
	Inherent Viscosity	*Flexural Strength*
	hr.	*hr.*
None	1900	700
Phenyl Salicylate	1900	700
2,6-Di-*Tert*-Butyl-*p*-Cresol	3500	800
p-Tert-Butylphenol	>3200	3500
N,N'-Diphenylacetamidine	>4400	>4400
Propyl Gallate	>4600	>4600
p-Butylaminophenol	>4700	>4700

[a] Sample thickness: 0.050 inch.

Mechanisms of Inhibition—The first necessary property of a weathering inhibitor is that it be the primary absorber of the ultra-violet light entering the plastic system. Unfortunately, this is not a sufficient

requirement, for then it would be easily possible to combine several compounds whose absorptions blanketed the range of harmful radiation. The absorbed ultra-violet energy must be disposed of in a manner harmless to the polymer chains, and this turns out to be a much more exacting requirement. No major fraction of the absorbed quantum must be transferred to the polymer chain in a single packet of energy. The inhibitor should have the ability to fritter the ultra-violet quantum rapidly away into small, harmless increments of vibrational magnitude. The remarkable photochemical stability of crotonaldehyde has been ascribed to this sort of property (26).

Molecular rearrangements offer a mechanism for achieving safe disposal of energy. Since it is equally essential to preserve the inhibitor in its active form, the rearrangement should reverse itself in the dark. A number of azo dyes are known to be phototropic on cellulose acetate yarn, changing to a different color when exposed to ultra-violet or visible light and returning to the original shade in the dark. These compounds are effective inhibitors of Weather-

Table XVIII.—Effectiveness of Phototropic Azo Dyes as Weathering Inhibitors for Cellulose Acetate Butyrate Plastic[a, b]

Inhibitor	*Time in Weather-Ometer Required for: 25% Loss in Inherent Viscosity*	*Development of Brittleness*
	hr.	*hr.*
None	400	400
Phenyl Salicylate	1000	800
p-Phenylazodiphenylamine	>1700	>1700
2,5-Dimethoxy-4-Phenylazoaniline	1500	900
4-(*o*-Chlorophenylazo)-N-Methyl-Toluidine	>1700	>1700
p-[(*p*-dimethylamino)-Phenylazo] Acetanilide	>2600	>3100

[a] 1 g. ester with 0.12 g. dibutyl sebacate and 0.01 g. inhibitor exposed in Weather-ometer.
[b] Sample thickness: 0.050 inch.

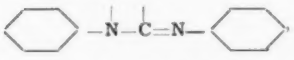
ometer breakdown when incorporated into cellulose ester plastic, as Table XVIII shows. The plastic formulation used in these experiments was cellulose acetate butyrate with 12 parts of dibutyl sebacate and 1 part of inhibitor. The mechanism of rearrangement occurring here may be the cis-trans isomerism discussed by Hartley (27), or in some cases, an azo-hydrazone shift (28).

An oxidation-reduction mechanism for regeneration of the inhibitor may play a part in the functioning of

certain types of inhibitors. Such a mode of action has been discussed by Murphy, Ravner, and Smith in connection with the use of phenothiazine as an antioxidant for ester-type lubricants (29).

Aryl amidines and aryl imino ethers undergo easy thermal rearrangements by an α-γ shift of a phenyl group or other substituent (30). Possibly this type of rearrangement also occurs photochemically. At any rate, these compounds are effective weathering inhibitors for cellulose ester plastic, as illustrated by Table XIX. The plastic formulation in this series of experiments was the same as that in Table XVIII, but the exposures were made in the modified Weather-ometer. Morey and Tichenor (31) recommended the use of N,N'-diphenylacetamidine as a weathering inhibitor for cellulose ester plastics.

Many derivatives of the molecular configuration,



were found to confer a high degree of weathering protection on cellulose ester systems. Many effective inhibitors, such as phenyliminobenzothiazolines (32), phenylaminobenzothiazoles, aryl amidines (31), aryl ureas, and aryl thioureas, fall into this classification. In all of these compounds, similar α-γ shifts of substituent groups are possible.

Aggregative Changes Caused by Light—In addition to chain breaking processes, chain building processes also were observed during weathering. Taylor and Tobolsky (33) have discussed the simultaneous occurrence of scission, cross-linking, and branching in vinyl polymers. Figure 5 illustrates the very delicate balance which can exist between these disaggregative and aggregative processes during Weather-ometer exposures of cellulose acetate butyrate plastic treated with tetraethyl silicate. The formulation used in these experiments contained 12 parts of dibutyl sebacate and 2 parts of titanium dioxide.

Table XIX.—Effectiveness of Rearrangeable Compounds as Weathering Inhibitors for Cellulose Acetate Butyrate Plastic[a, b]

Inhibitor	*Time in Modified Weather-ometer Required for 25% Loss of:* *Inherent Viscosity*	*Flexural Strength*
	hr.	*hr.*
None	160	175
Phenyl Salicylate	900	700
N,N'-Diphenylacetamidine	1200	1300
N,N,N'-Triphenylacetamidine	1250	1000
Phenyl N-Phenylbenzimido Ether	1000	700

[a] 1 g. ester with 0.12 g. dibutyl sebacate and 0.01 g. Inhibitor exposed in Weather-ometer modified by addition of 8 Westinghouse fluorescent sun lamps.
[b] Sample thickness: 0.050 inch.

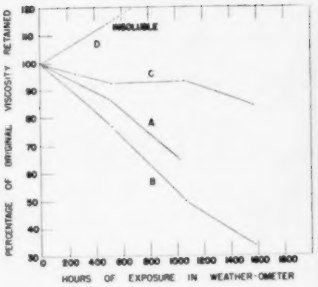
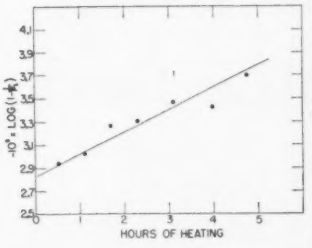


Fig. 5 (above)—Weathering of cellulose acetate butyrate plastic treated with tetraethyl silicate. Minutes of soaking in 1:1 ethanol-tetraethyl silicate are: A, 0; B, 15; C, 85; and D, 290 (the dotted line indicates insolubility). Fig. 6 (below)—Molecular weight breakdown of the same plastic at 190°C.



Kinetics of Breakdown

Thermal Breakdown—Suppose we heat m grams of cellulose ester whose number-average degree of polymerization is $\overline{P}_o$ for a time t, at some fixed elevated temperature, so that the degree of polymerization drops to $\overline{P}_t$. The number of chain links in the system, originally N_o, will drop to N_t, where

$$N_o = \frac{m(\overline{P}_o - 1)}{u \cdot \overline{P}_o}$$

and

$$N_t = \frac{m(\overline{P}_t - 1)}{u \cdot \overline{P}_t}$$

Here, u represents the mass of the anhydroglucose unit of the cellulose ester chain. If the number of links

breaking per unit of time is proportional to the total number of links present, that is, if breakage is random, then

$$-\frac{dN}{dt} = kN$$

or

$$N_t = N_o\, e^{-kt}$$

Thus

$$\frac{\overline{P}_t - 1}{\overline{P}_t} = \frac{\overline{P}_o - 1}{\overline{P}_o} \cdot e^{-kt}$$

or

$$\ln\left(1 - \frac{1}{\overline{P}_t}\right) = \ln\left(1 - \frac{1}{\overline{P}_o}\right) - kt \quad (A)$$

This is the equation given by Wolfrom, Sowden, and Lassettre (34) for the acid-catalyzed hydrolysis of methyl cellulose. Data obtained for degradation of cellulose acetate butyrate at 190° C. also obeyed equation A reasonably well, as shown in Fig. 6. Heating was carried out in a glass tube containing 7.5 g. of the cellulose ester and 10 ml. of dimethyl phthalate. This was held in an oil bath with the tube open to the atmosphere and was kept stirred by a Brookfield viscometer bob. Dilute solution viscosities, run on samples withdrawn from the melt from time to time, were used (12) to estimate the number-average molecular weights shown in Fig. 6.

Ultra-violet Breakdown—If, as in the case of thermal breakdown, we assume random breakage of chain links, the kinetics are quite simple. The number of links breaking per unit of time is constant, at least in the initial stages of degradation. Calling this constant k', we may write

$$N_t = N_o - k' \cdot t$$

or

$$\frac{1}{\overline{P}_t} = \frac{1}{\overline{P}_o} + k'' \cdot t \quad (B)$$

where

$$k'' = \frac{u}{m} \cdot k'$$

Figure 7 shows how well equation B fits data calculated from viscosity measurements (35) of Walker, Tichenor, and Morey on 0.012-in.-thick films of cellulose acetate butyrate plasticized with 10% of triphenyl phosphate. Exposures were made with a General Electric S-4

lamp at a temperature of 55° C. The linear relationship of reciprocal molecular weight with exposure time was preserved to a remarkably high degree of degradation.

The agreement of the thermal and ultra-violet breakdown data with equations A and B is taken to indicate that chain link breakage was random in both types of breakdown. This implies that the original cellulose ester contained no weak links.

Summary

Many plasticizers containing methylene or methylidyne groups were found to be susceptible to oxidation at 150° C. and thereby induced chain length breakdown in cellulose esters. Antioxidants prevented this type of degradation; heavy-metal soaps and titanium dioxide catalyzed it.

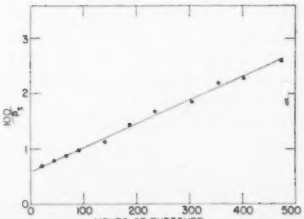
Severe thermal breakdown was caused by traces of strong mineral acid or by certain ferric salts. The former type of breakdown could be largely prevented by the addition of acid acceptors, the latter by metal deactivators.

Oxidative degradation, induced by the presence of autoxidizable plasticizers, still played a part, though a less important one, in the breakdown produced by irradiation with ultra-violet light.

Agreement of calculated with observed rates of ultra-violet breakdown indicates that the inhibiting action of phenyl salicylate is due to its ability to function as an inert inner filter.

It is postulated that compounds such as aryl amidines and azo dyes are effective inhibitors because they can safely dispose of absorbed energy by processes of molecular rearrangement.

Fig. 7—The molecular weight breakdown of cellulose acetate butyrate by ultra-violet light



The kinetics of breakdown by heat and light were shown to be consistent with the theory that breakage of chain links is a random process in both thermal and ultra-violet degradation.

We are greatly indebted to many of our associates for advice and assistance, especially to Miss Harmon Long for conducting experiments on heat breakdown, to Dr. G. M. Armstrong for supervising the compounding of plastic samples and the physical testing of weathered specimens, to Mr. G. R. Greear and Mr. G. N. Newland for help with the weathering experiments and viscosity measurements, and to Mr. L. W. A. Meyer for furnishing us with many of the plastic test materials and for continued helpful advice.

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Big Pieces from Little Pieces via Resorcinol

THE importance of resorcinol and phenolic type glues in the present defense program is pointed up by the Navy's recently announced minesweeper program. Some 20 shipyards will take part in this program to build several hundred boats of from 57 to 158 ft. in length.

Resorcinol glue has been sparingly used in the civilian economy because of its cost, even though its high grade adhesive qualities are well known. Estimators say that about $600 worth of raw materials, such as benzene, caustic soda, sulfuric acid, oleum, muriatic acid, and others, are required to produce a ton of resorcin. This is an unusually high percentage cost for commercial chemicals. Resorcin sells in the 80¢ range and the glue is three to four times more costly than phenolic glues. Resorcin-formaldehyde glue, however, which cures with low heat (60° F. on softwood to 140° F. on oak) and at simple clamping pressure, is a highly desirable commodity for construction of large structural parts. Its future looks so promising that Koppers is increasing its production capacity by several million lb. a year. Borden Chemical has announced a new plant that will bring in 1 million lb. a year, and Heyden Chemical is increasing its plant capacity to a 1 million lb. rate. Furthermore, the use of resorcin-formaldehyde glue broadens the use of phenol-formaldehyde glue, since the latter is frequently used with resorcinol glues in wood laminates. Most wood laminates employ a mixture of either 80% phenolic and 20% resorcinol or a 60-40 proportion.

Many uses for resorcinol—Resorcinol-formaldehyde latex is also coated over synthetic fiber cord used in tires and belting because it gives an intimate, durable, heat-resistant bond. Adhesives for wood and fibers take 50% or more of resorcinol production, but it has many other uses. It is also an antiseptic for medical use, and has been used with streptomycin, although there is some doubt as to its future in this field. It is a whitening agent in detergents and soap; is useful in dyestuffs; is an explosive primer for small arms ammunition; and has a growing new use as a tanning agent.

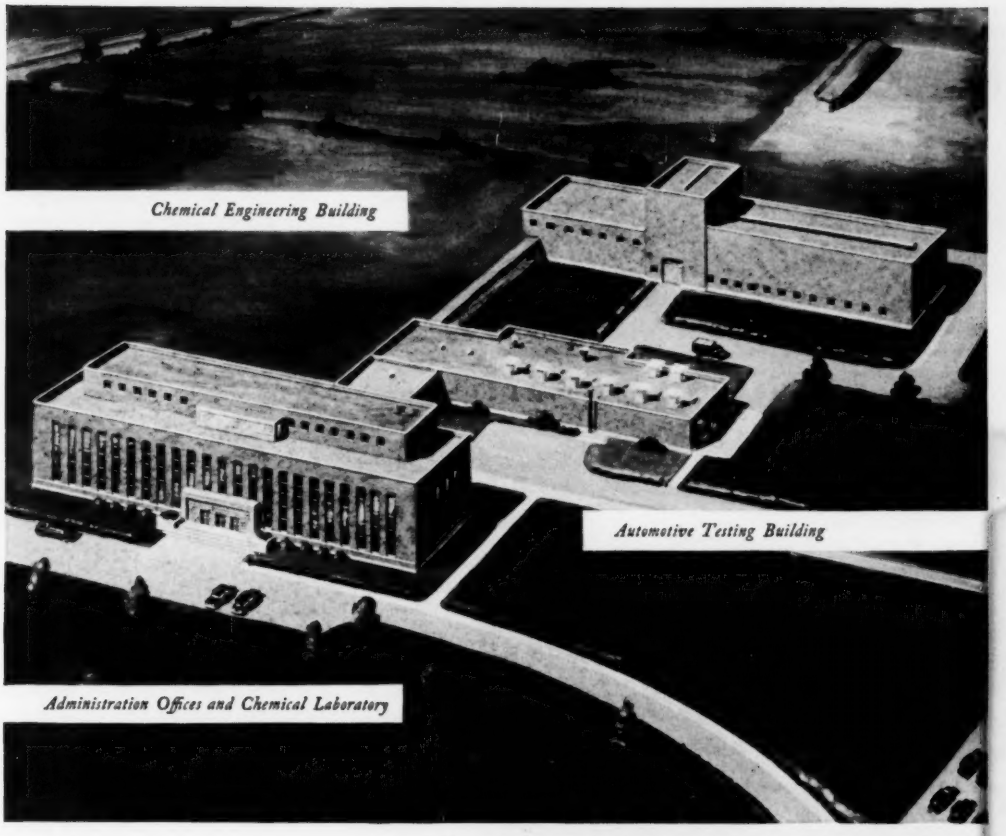
There is a belief among many industry observers that the plans to enlarge resorcinol production is a "calculated risk" of considerable proportion. It could be a "war baby" of limited civilian application. After World War II, anyone who used 10 or 15 thousand lb. of resorcinol a year was a big customer. However, chemical companies must always gamble on the future when they expand facilities and, although no immediate heavy demand for resorcinol in civilian applications may be obvious to the layman, producers declare that this same situation has frequently occurred in the development of many other chemicals. They point out particularly that resorcinol is unique in its capacity to react quickly with other materials—that the present-day commercial grade gives several times better performance than the war time grade. They admit that time will be required to find markets, that they may have to show customers how to use it, and that total production may not be sold. But since resorcinol will now have to be sold as a material that specifically fits a certain job, it will gradually obtain permanent status and be much more certain of its future than materials which are now sold as replacements. There is a general feeling that if cost could be reduced one half, resorcinol glue would immediately take over a huge portion of the adhesive market, but there is as yet no evidence that any such cost reduction is in the cards.

Laminated wood has promising future—As mentioned above, one of the most common uses for resorcinol heretofore has been in laminated wood, in which layers of wood are glued together to obtain long, wide, and thick members with greater strength than solid timbers of the same dimensions. The inner sections of laminated wood may be of low grade lumber, thus cutting costs. The finished pieces are virtually split proof and will hold fastenings better than will solid lumber. Laminated structural shapes are stronger, pound for pound, than steel. Furthermore, they are not subject to extensive damage from flash fires such as that occasioned by jets. A wood truss is often better protection in case of fire than is a steel beam. This is evidenced by statements of the Firemen's Association which indicate that they would rather fight fire in a warehouse supported by wood beams than in a structure with steel beams. The reason is obvious—heat softens steel so that it loses the support factor, whereas wood trusses may char no more than ½ in. in a half hour exposure.

Variety of uses steadily increases—Hardwoods such as walnut, pecan, birch, mahogany, and oak for gun stocks, furniture, and for use in boats are commonly laminated. Fir, spruce, pine, and redwood are the most commonly laminated softwood types. Teak laminates for ship decking and laminated masts for Signal Corps and radar use are comparatively new uses. Another is laminated lumber poles to hold up high tension wires when repair work is undertaken. Skies, toboggans, and pontoon bridges are older uses. These laminated wood products should in no sense be confused with impregnated, compressed wood laminates; manufacture of resorcinol laminates involves pressures not exceeding 300 p.s.i.

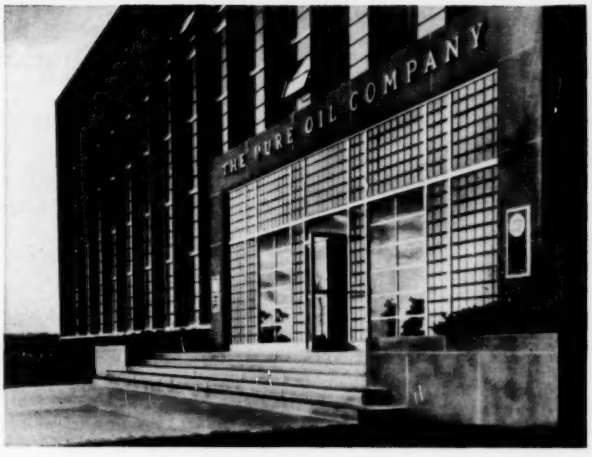
The military program is already scheduled to consume around 1 million lb. of resorcinol in 1952. Another 200,000 lb. has been set aside for patching plywood, an operation that makes possible the full utilization

* Reg. U.S. Pat. Office.



Crystal Lake
LABORATORY

When Pure Oil Company considered building a Research and Development Laboratory at Crystal Lake, Illinois, Stone & Webster Engineering Corporation was engaged to make preliminary studies and estimates. It later designed and furnished engineering supervision during the construction of the project.



STONE & WEBSTER ENGINEERING CORPORATION

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of plywood veneers that might otherwise be thrown out because of knotholes or surface faults. In the Navy's boat program, rescorcinol glue is not only used in laminated wood but in gluing plywood to the frame and for fabricating stress skin structures for shelters or combat facilities.

How wood can replace metal—But the great possibilities of resorcinol glue and the other glues that go hand-in-hand with it in the Armed Services program are in structures where they are not yet applied.

Readiness hangars are an example. The Air Force uses several types of hangars at each air field—86-ft. Alert; 168-ft. Readiness; 300-ft. Storage. The Readiness type, already designed in wood but not being purchased at present, could easily be put up in laminated and plywood to save several hundred tons of steel per unit.

The Corps of Engineers recently let a $250,000 contract for metal truck bodies which, if done in laminated and plywood, would save from 1500 to 2200 lb. of steel per unit. Revised designs and specifications are now being developed for wood cargo truck bodies. Not only does wood save metal but, because it is stronger by weight, it adds as much as 500 lb. to the possible payload.

Contracts for Quonset type steel frames for 11,000 shelter units have recently been let—several thousand more will be purchased this year. Approximately five tons of steel per unit could be saved by employing laminated wood or an alternate wood structure design. Designs in wood have also been submitted for warehouse type buildings which ECA uses overseas. Several hundred of these have already been shipped—and each one used 79 tons of steel.

The Transportation Corps is preparing to purchase for overseas shipment 2000 freight cars of the small type used in Europe. These will be constructed of plywood top and sides, hardwood or softwood lumber on the floor and ends. This is an example of what can be done.

The field of military packaging is also a major outlet for possible use of resorcinol adhesives if new design modifications for boxes are adopted. The new proposed designs will give extra strength, save material, and cut final costs.

AEC Releases Patents

DESCRIPTIONS of 30 patents owned by the U. S. Government and held by the Atomic Energy Commission have been made available to industry. Non-exclusive, royalty-free licenses will be granted on these patents, which are listed in the U. S. Patent Office.

Following are three patents of particular interest to the plastics industry: No. 2,567,956, "High Pressure Polymerization of Perhaloolefins," which pertains to a method of producing commercially satisfactory solid polymers from halogenated compounds of carbon and fluorine or carbon, fluorine, and chlorine containing two to four carbon atoms; No. 2,573,639, "Manufacture of Porous Articles from Trifluorochloroethylene Polymer," which discloses a method wherein the finely divided powder of the polymer is cold molded at a pressure greater than 500 p.s.i. and, after removal from the mold, is sintered at an elevated temperature not more than 250°C.; and No. 2,574,619, "Process for the Preparation of Fluorocarbons," which describes a method of producing saturated fluorocarbons.

Complete descriptions of the 30 patents may be obtained from the U. S. Patent Office. Applicants for licenses should apply to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C.

Mica Laminates

RECENT announcement that a special process by which minute mica flakes are so treated that a force is generated which holds the tiny particles together could be of particular interest to laminators who specialize in electrical jobs.

General Electric Co.'s Chemical Div. has announced the development of this new process, stating that the resulting product is in the form of a continuous sheet produced in thicknesses ranging from 0.002 to 0.006 in. and that it has better dielectric strength than present machine- and hand-laid mica products. This development makes it possible to use American mined mica, formerly useless for most high quality work. Referred to as G-E Micamat, commercial production is now under way. Micamat is capable of being impregnated with resins and being bonded to paper, glass, and cloth with improved electrical properties to give tapes and sheets that can be used in heating devices, in motors and generators, or machine-wrapped on bars and cables. A combination such as high heat resistant silicone and mica would have outstanding insulating qualities to offer laminators specializing in electrical work.

Copper-, Aluminum-Clad Laminates

TWO grades of Insurok laminated phenolic—T-725 and T-812—are now being offered as copper-clad and aluminum-clad sheets by The Richardson Co., 2765 Lake St., Melrose Park, Ill. These metal-clad laminates can be printed and etched to produce "printed circuits" for use in radio, television, and other electrical assemblies. The metal foil is bonded to the laminate under heat and pressure and provides high bond strength for this class of material. Electrical properties of the Insurok grades remain unimpaired.

Sheets are available in 36 by 42 in. sizes, in thicknesses from 1/32 to 3/32 in. inclusive.

Decyl Alcohol Plasticizers

A COUPLE of years ago Hercules Powder Co. announced a new phthalate type plasticizer made from a combination of octyl and decyl alcohols. Decyl alcohol is produced from cocoanut oil. The new plasticizer gave exceptionally good low temperature performance, had low volatility, and exhibited excellent stability to heat and light. But production was limited. The company has recently announced that capacity for production of Hercoflex vinyl plasticizers has now been stepped up 40 percent.

The increase in plasticizer output makes a third plasticizer, Hercoflex 290, available for the first time in tank car quantities. Hercoflex 290 is the adipic acid ester of a blend of octyl and decyl alcohols. It combines the low temperature performance and economy of adipates with the

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ten years of specialized experience in the precision engineering and
of astrodomes, canopies and other acrylic parts.

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of the aircraft industry with duplicated facilities and tooling a

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low volatility associated with conventional phthalates, azelates, and sebacates. It is particularly recommended for use in the production of low viscosity plastisols.

Plastisol Coating

TOP coating a material by the use of plastisols is a concept recently developed by Deecy Products Co., 120 Potter St., Cambridge, Mass. The vinyl plastisol incorporates a plasticizer, Staflex KA, which gives it excellent resistance to bleeding, sweating, or blooming. Other properties of the plastisol are rapid fusion, high hardness, satisfactory light resistance, high clarity, and good resistance to water and soap. With the use of this plastisol, thickness of top coatings can be varied from 1 mil up and, the company claims, coatings as high as 40 mils thick appear to be practical.

Upholstery Fabric

TO its Fabrilite line of supported vinyl plastic upholstery, Du Pont has added Barony, a tweedy textured pattern with semi-luster. Supported by a strong fabric backing, the material is long wearing; it can be wiped clean with a damp cloth, and the luster restored by rubbing with a dry cloth.

Electrical Tubing

SAID to possess exceptional flexibility and heat endurance, a new electrical tubing has been announced by Irvington Varnish & Insulator Co., Irvington, N. J. Known as Silicone Rubber Coated Fiberglas Tubing, the material is a Class "H" product and will withstand exposure of 200 hr. at 200° C. without becoming brittle.

Dividends From Research

SIGNIFICANT contributions to the formulation of elastomer-resin compositions; development of the new acrylic elastomers, including acrylic sponge; and improvements in internally plasticized vinyl acetate and vinyl chloride copolymers are listed among the accomplishments of the comparatively new firm, Delaware Research & Development Corp., Brett Rd., New Castle County Airport, New Castle, Del.

Materials now in commercial use resulting from formulations developed by the corporation include a new composition affording industrial plants and laboratories a resilient flooring material having superior chemical and wear resistance; another composition with excellent electrical characteristics combined with rigidity and toughness even when exposed to exceptionally humid conditions; and still another which can withstand tremendous mechanical abuse, has an unusually high heat distortion temperature and yet may be post-formed readily to replace such widely dissimilar materials as lead and rock maple at significant savings in final cost.

The company was formed in 1950 by a group of Wilmington businessmen and technicians primarily to develop industrially useful products incorporating the unique mechanical, electrical, and chemical properties resulting from combinations of natural and synthetic rubbers and resins.

Chairman of the company is Charles L. Petze, Jr.; president is Charles L. Wiswall; treasurer is Frank D'Orazio; assistant treasurer, Clark W. McKnight; and assistant secretary, John B. Miles.

The specialized equipment to provide for this company's research and development work includes testing equipment manufactured by Tinius Olsen, Scott, American Instrument, Gardner, Shore, and several others.

Junior Plasticators

MANY sound thinkers in the plastics industry are considerably disturbed about where the future manpower for this industry is going to come from. They fear that only a small portion of our boys and girls are interested in the chemical and affiliated industries because of the complexities involved. It is, therefore, heartening to read of an incident in the public school at Clayton, Mich., whereby students manifested an unusual amount of interest in the plastics industry.

Each student in the eighth grade in that school wrote to a plastics company asking for the privilege of representing that company in a display of plastics to be presented by the school. They asked for samples and literature. Thirty companies responded. On the night of the display, the class operated a small injection molding machine. At Christmas time, the class made Christmas tree ornaments from a cold pouring thermosetting material and fluorescent pigment.

An unusual amount of enthusiasm was reported to have been developed among both the students and the townspeople who became interested in their work. Perhaps this is an indication that Junior America can be interested in plastics and chemicals just as well as in cowboys and detective thrillers if the industry will take the time to cultivate and assist them.

Decals for Plastics

SPECIAL decal nameplates, markings, and decorations for plastics materials have been developed by American Decalcomania Co., Chicago, Ill. Sticktite Type 200 is designed to adhere to phenolic and acrylic plastics, but it also provides maximum abrasion resistance and long life on metals, leather, baked enamel, and fiber board. Polycal decorations were developed for polystyrene products, Type C.A. for cellulose acetate, and Vinylcals for both flexible and rigid vinyls. All the decals are applied with water alone, except Vinylcal, which is applied with a special solvent furnished by the manufacturer.

Low Cost Reinforcement

LAMINATES and molded parts made with a new low cost reinforcement, designated Conoweve, have a smooth surface and excellent thickness tolerances, according to the producer, Continental Paper Grading Co., 1623 Lumber St., Chicago, Ill. Conoweve is an unwoven cotton mat available untreated or impregnated to customers' specifications. Complete technical data and samples will be supplied by the manufacturer on request.

Reinforced Honeycomb for Aircraft

AVAILABILITY of Hexcel glass fabric honeycomb in pre-shaped pieces to speed aircraft construction has been announced by California Reinforced Plastics Co., 1444 4th St., Berkeley, Calif. The product is

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already being used in radomes for North American Aviation's F86D all-weather fighter.

The honeycomb material is first pre-curved to eliminate the anticlastic, or saddle, shape that normally results when flat honeycomb is formed or bent. It is then precut to eliminate waste trim during fabrication and to allow rapid lay-up with a minimum number of pieces and joints.

Hexcel honeycomb for the F86D is furnished in 13 identical pieces and one nose piece for each dome. It is also tapered in thickness to give the optimum microwave transmission characteristics.

Hyatt Award Nominations

NOMINATIONS are now being accepted for the Eleventh John Wesley Hyatt Award which is presented annually for outstanding achievement in the field of plastics. The winner receives the John Wesley Hyatt Gold Medal and $1000.

Entries are invited from everyone connected with the plastics industry, as well as from chemists, laboratory technicians, and executives. There is no entry fee. Nominations close April 1, 1952. For entry blanks or further information, write to the Committee Secretary, William T. Cruse, 67 West 44 St., New York, N.Y.

Tote Boxes

AS AN addition to the standard line of tote boxes manufactured by Durable Formed Products, Inc., 329 Canal St., New York, N. Y., the company has announced a giant tote box which measures 27 in. long, 23 in. wide, and 15 in. high. Made of one sheet of Royalite that resists chipping and most alkalies and solvents, the box weighs 7 lb. but will withstand a load of up to 175 pounds.

High Strength Sheeting

DECORATIVE high-strength reinforced polyester-glass sheeting has recently been developed by The Dynakon Corp., 5509 Hough Ave., Cleveland, Ohio. Called Dynakon A3A, the sheet is temperature and solvent resistant to 300° F., and is recommended for use in luggage, handbags, furniture, panels, appliances, and instruments. Strength and scuff resistance of the material is extremely high, the strength weight ratio being higher than that of steel.

Dynakon A3A is available in sheets 18 in. by 28 in. and in thicknesses of 1/16 and 1/8 inches.

Butyl Additive

USE of 10% of Kenflex A in butyl rubber results in compounds which possess molding and extruding characteristics comparable even to polyethylene, is the claim made by Kenrich Corp., 120 Wall St., New York, N.Y., for its new hydrocarbon resin, Kenflex. The new resin not only helps to process butyl rubber compounds more easily but does not change the material's power factor or resistance to ozone.

To Users of Dielectric Equipment

ATTENTION of all users of induction and dielectric heating equipment, particularly those whose equipment was manufactured prior to June 15, 1947, is called to the provisions of the FCC Rules and Regulations, Part 18, relating to radiation and communication interference from industrial induction and dielectric heating equipment.

The National Electrical Manufacturers Association, 155 East 44 St., New York, N. Y., Induction and Dielectric Heating Apparatus Section, feels that it is of the utmost importance that this deadline be brought to the attention of users of industrial high frequency heating equipment in time for them to take the necessary steps to obtain FCC certification before June 30.

In essence, the rules require certification, on or before June 30, 1952, of compliance with certain minimum radiation requirements for all equipment installed or manufactured prior to July 1, 1947. A period of five years was allowed by the Commission for users of uncertified equipment to properly check and obtain certification of their equipment. A complete copy of the FCC Part 18 may be obtained from the U.S. Gov't. Printing Office, Washington, D. C.

It is suggested that users of older type equipment contact the manufacturer or a consulting engineer for guidance in complying with the rules. In addition, full details on suppression of radiation will be found in the article, "Curing RF Heater Television Interference," p. 101, MODERN PLASTICS, Sept. 1951.

Graduate Work in Plastics

THE Graduate School of Princeton University has instituted an engineering curriculum of study and research in plastics leading to a Master of Science in Engineering. Instruction covers properties, evaluation, production, fabrication, design, and application of materials, as well as the chemistry of plastics. In addition to research assistantships, fellowships have been donated by Bakelite, Phillips Petroleum, Celanese, and Firestone Plastics.

Applicants for admission must hold a Bachelor's degree in engineering or physical science from a recognized institution and must meet general admission requirements of the University. Further information can be obtained from Louis F. Rahm, Plastics Laboratory, 30 Charlton St., Princeton, N.J. Professor Rahm recently announced that Russell B. Kirby, Jr., is the recipient of the first Firestone Plastics Fellowship.

Silicone for Masonry

PATENTS for the application of silicone materials to masonry for water repellency have just been granted The Wurdack Chemical Co., St. Louis, Mo., which markets the product as a clear transparent fluid under the trade name Crystal. The protective coating may be sprayed on in any temperature and weathering tests have indicated a life as long as ten years from a single application.

Benzonitrile Available Again

COMMERCIAL quantities of benzonitrile, a colorless liquid produced by the catalytic reaction of petroleum raw materials with ammonia, are now available from Socony-Vacuum Oil Co., 26 Broadway, New York, N. Y., exclusive producer. Production had been curtailed by a shortage of the basic raw materials. Greatest use of benzonitrile at present is in the manufacture of melamine resins. A company spokesman points out that the chemical will also

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be of research interest to the vinyl industry because its volatility should make it extremely useful as a fugitive plasticizer.

Institute Officers

THE New York Chapter of the Industrial Designers Institute recently elected the following officers: president, Robert L. Gruen; vice president, Robert I. Goldberg; secretary, Elizabeth Dralle; and treasurer, Ann Franke.

Anti-Static Agents

TWO anti-static compounds are now being marketed by Merix Chemical Co., 1021 East 55 St., Chicago, Ill., for use on plastic surfaces. No. 79 is principally wiped, sprayed, or brushed on smooth surfaces; No. 79-OL is used on textiles and plastic fabrics. Both compounds are noninflammable, fairly fast drying, and practically invisible when dry.

Machinery Div. Changes Hands

PURCHASE of the rubber and plastics machinery division of National-Erie Corp., Erie, Pa., has been announced by The Aetna-Standard Engineering Co., Frick Bldg., Pittsburgh, Pa. Included in the purchase are drawings, patterns, and special equipment for the manufacture of rubber and plastics machinery which will be produced at the new owner's Warren, Ohio, plant. This machinery includes mills, washers, extruders, Banbury mixers, and vulcanizers.

Identification of Plastics Parts

THE Mechanical Rubber Goods Manufacturers Div., The Rubber Manufacturers Association, Inc., has been selected by the ASTM-SAE Joint Committee to make all future assignments of identification code numbers and symbols for the following rubber and plastics articles: molded goods, extruded goods, windshield wiper hose, defroster tubing, radiator hose, heater hose, fuel and oil line hose, hydraulic brake hose, vacuum brake hose, vee belts, brake linings, clutch facings, electrical wiring, and molded rings.

All manufacturers of the above articles who have not already been assigned identification codes or markings are requested to write to Mr. J. J. Catterall, Executive Secretary, Mechanical Div., The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y., requesting an assignment from that organization.

Fluorinated Coating

DEVELOPMENT of a new fluorinated plastic resin resistant to the most highly corrosive chemicals, and impervious to salt, heat, and moisture has been announced by The Firestone Tire & Rubber Co., Akron, Ohio. Known as Veloform F-10, the product has been specified by the Air Force as a protective coating for the exterior of large tank trailers that transport fuming nitric acid; other coatings used for this purpose were destroyed immediately by spillage of the acid.

Because of its high moisture vapor resistance, Veloform F-10 is considered an ideal coating for electrical equipment, such as resistors, capacitors, and wiring, which must be protected from the corrosive action of moisture and salt spray.

The coating is applied by brushing, spraying, or dipping, and it can be used on plastics, metals, wood, and rubber-like products. Entire output at present is going for military and defense purposes.

Polystyrene Brush Bristles

DURABLE polystyrene brush bristles, designated Polyfil, are now in production at the Arlington, Vt., plant of Mack Molding Co., Wayne, N. J. Polyfil bristles are available in clear styrene, or in permanent and nonfading colors.

Quartz Paper

QUARTZ, the crystalline form of silica and the most perfect electrical insulating material found in nature, has been duplicated chemically in the form of fibers by Glass Fibers, Inc., 1810 Madison Ave., Toledo, Ohio. Highly specialized glass fiber produced by the company has been made into quartz paper. The resulting product has a high temperature resistance up to 3000°F., provides minimum electrical losses at high frequency, and has proved relatively unaffected by radiation.

Initial use of the new quartz paper will be as a high-temperature, nondeteriorating electrical insulating material. It also has strategic importance as a replacement for asbestos.

Trial Lots Available

A NEW chemical is now being offered in trial lot quantities by American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y. The material is N,N'-Methylenebisacrylamide, a reactive, bifunctional monomer which undergoes reactions typical of its vinyl and amide groups. Its suggested uses are in molding compounds, surface coatings, textile finishes, and ion exchange resins, and as a cross-linking agent with other vinyl monomers.

Vinyl Coated Fabric and Sheeting

DESPITE the slump in late 1951, volume of both vinyl sheet over 10 mils thick and vinyl coated fabric was slightly over 1950, according to figures published by the Plastic Coatings & Film Association. Their reports are estimated to cover 80% of total shipments of sheeting and 62% of all coated materials. Volume for the past five years reported by their membership is as follows:

	Coated Fabric Lin. yd., 54 in. average width	*Sheeting over 10 mils Sq. yd.*
1947	12,162,503	6,922,366
1948	16,323,561	12,316,758
1949	28,772,122	24,770,382
1950	36,561,646	43,219,422
1951	40,294,657	49,507,551

With the missing 20% added to the sheeting figure for 1951, the total would be over 61 million sq. yards.

Readers will note that if one lb. of compound is used per sq. yd. of sheet, and that's a liberal amount, this PCFA total is far less than most other estimates used in the industry. The MODERN PLASTICS estimate, January 1952 issue, for all vinyl sheeting over 10 mils thick was 70 million lb. of resin, which would make approximately 127 million lb. of compound. Some of this, but certainly not enough to make up the difference, was used for floor coverings. Then, of course, there is a wide disparity of opinion on the average percentage of plasticizer and filler used in the compound. The disparity in various

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Lustrex LH, with its increased toughness, reduces troublesome breakage in shipment and use. And all this with good gloss. Lustrex LH will enable many manufacturers to upgrade their products, to put new ones on the market, and to provide new talking points for greater sales.

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CHEMICALS—PLASTICS

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estimates illustrates the difficulty of obtaining accurate figures for the plastics industry and is a warning to all investigators that plastics statistics must be cautiously used and carefully interpreted.

Of the 89,802,208 yd. of vinyl coated fabric and vinyl sheeting shipped in 1951, PCFA members estimate that 48% was used for furniture upholstery, 15% for handbags and accessories, 20% in the automotive and transportation field, 7% in luggage, 6% in shoes, 4% in other products.

In the eight months (May through December, 1951) that the PCFA has been reporting government business, shipments of plastic coated materials on government orders have totaled 7,920,000 linear yards.

Pyroxylin coated materials were shipped by Association members in the amount of 34 million linear yd. in 1951 in comparison to 39 million linear yd. in 1950.

Tough Styrene

THERE is an interesting story behind the announcement of Monsanto's new L-H ("H" for "hard") styrene molding material. It is a polyblend, a combination of Monsanto's regular styrene crystal polymer plus some of the company's L-T ("T" for "tough") material.

The L-T material was developed for a specific military use. While it is exceptionally tough, it could not be translated directly into civilian applications with economy because it was difficult to mold to a good finish. As this tough formulation became more available, toy manufacturers and others were encouraged to experiment with it in combination with styrene crystal, and thereby gain a practical idea of what would be needed in those fields in toughness in comparison with regular styrene. The final and most satisfactory formulation worked out to 25% of L-T and 75% styrene polymer. This formulation is the new L-H mix. It has good moldability with cycles improved, if anything, over regular styrene, has excellent surface finish, and good aging properties.

Heat dispersion point of the new L-H material is 194° F. Its impact strength is from 50 to 100% better than regular styrene, with no loss in either flexural or tensile strength. It sells for just 1¢ a lb. over the price of regular crystal styrene. It is available in nine stock colors, and has a wider color tolerance than crystal styrene. The company proposes to market it to makers of toys, housewares, stationary specialties, and refrigerator parts, which currently embrace 90% of the applications for translucent colored styrene.

EXPANSION

Electronic Rubber Co., Stamford, Conn., announces expansion of facilities to include the manufacture of polyvinyl chloride injection molding and extrusion compounds for non-electrical uses. Heretofore, the company was primarily a wire coater and developed high temperature performance vinyl compounds for such uses; a new rigid compound is currently under evaluation for household applications, particularly in kitchen and bathroom fixtures.

Bakelite Co. (Canada), Ltd., has started construction on a new plant at Belleville, Ont., for production of formaldehyde. **Standard Chemical Co. Ltd.** has been named distributor for the formaldehyde materials produced there.

Shawinigan Chemicals Ltd. has announced construction plans for a $7 million carbide plant at Varennes, Que., Canada. The plant, to be built on a 200-acre site fronting the St. Lawrence ship-channel, will have an annual capacity of 100,000 tons of carbide.

U. S. Rubber Co., Naugatuck Chemical Div., announces major expansion of facilities for the manufacture and sale of rubber latex and plastics materials on the West Coast. A new plant and offices have been completed on Telegraph Rd., Los Angeles, Calif., which include customer technical service laboratories.

Schwartz Chemical Co., Inc., 326 West 70 St., New York, N. Y., has opened its first branch plant at 41 San Jose Ave., Burbank, Calif. The new factory is fully equipped to manufacture the company's Rez-N-Brand line of chemicals for cementing, lacquering, dyeing, and cleaning of plastics products.

Ferro Corp., 4150 East 56 St., Cleveland, Ohio, has tripled production of its **Plastic Color Div.** by the installation of new continuous process machinery.

Du Pont Co. has begun installation of machinery and equipment for the manufacture of cellulose sponge in Columbia, Tenn. The buildings were put up in 1944 by the government for the production of activated charcoal for gas masks, but were never used for that purpose. The new plant will be operated by the **Film Dept.**, and production is scheduled to start by the end of this year.

Acheson Industries, Inc., 420 Lexington Ave., New York, N. Y., has acquired the properties of the **Peerless Printing Ink Co.**, Ontario and Janney Streets, and **Synthetic Lacquer & Varnish Co.**, 3392 Tulip St., both of Philadelphia, Pa. The two properties will be combined and operated as **Peerless Printing Ink Co.** in a move to expand the activities in pigment dispersions now in demand in the plastics and surface coating industries. **Albert H. Gere**, former president of Peerless, is president of the new subsidiary.

Monsanto Chemical Co. announces expanded facilities for the production of benzoic acid at its John F. Queeny plant in St. Louis, Mo. The new unit, which will produce the acid by an entirely new synthesis from basic raw materials, doubles the company's production of technical and U.S.P. grades of benzoic acid, as well as Benthal, Monsanto's benzoic acid for the alkyd resins industry.

Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Detroit, Mich., has just received a Certificate of Necessity providing $1,475,000 for expansion of its phenol plant at Tuscaloosa, Ala.

COMPANY NOTES

U. S. Plywood Corp. has opened a new sales and distribution office at Prospect St. and Railroad, High Point, N. C.

Godfrey L. Cabot, Inc., 77 Franklin St., Boston, Mass., has appointed

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Henry L. Grund Co., 406 Bulkley Bldg., Cleveland, Ohio, as exclusive agent for the firm's carbon blacks used in the plastics, paint, ink, and related industries. Grund will service Cleveland and northern Ohio.

B. F. Goodrich Chemical Co. has announced the following promotions in the plastic materials sales department: **George E. Field** has been named field sales manager; **Phillip J. Weaver**, technical service manager; **Robert F. Dettlebach**, Eastern sales manager; and **Clyde D. Segner**, technical staff representative. **Orville E. Isenburg** has been appointed international sales manager, succeeding **James C. Richards**, who was recently elected vice president of sales.

The company also announces the removal of its Pacific coast sales offices to Suite 301, 714 West Olympic Blvd., Los Angeles, Calif. Sales representatives in the new location are R. E. Bitter and T. A. Hoyle.

Lermer Plastics, Inc., 502 South Ave., Garwood, N. J., has been formed by **Herman B. Lermer** and **Irving S. Lermer**, formerly president and vice president, respectively, of Celluplastic Corp. The new company will specialize in such plastics products as containers, applicators, and medical devices, as well as in custom injection molding.

R. S. Aries & Associates has opened a branch office in Tokyo under the management of **H. F. Alber.**

Barrier-Pribble & Co., Inc., plastics consultants, announces the enlargement and removal of its facilities to 554 Eben St., New Haven, Ind.

Doram Products, Inc., 410 Frelinghuysen Ave., Newark, N. J., announces facilities for formulating standard and special coatings for use on plastics materials before they are metallized.

General Electric Co., Pittsfield, Mass., announces the following personnel changes in its **Chemical Div.: Edward J. LeBeau** has been named quality control supervisor of the phenolic products plant; **Edwin M. Irish, Jr.**, is phenolic products sales manager of the chemical materials department; **William L. Rodich** has been promoted to general manager of the laminated and insulating products department; **Elmer Devor** is supervisor of industrial engineering at the Coshocton, Ohio, plant; **John Staley** is supervisor of mechanical process development; and **Emmett E. Hinson** has been assigned as sales representative for industrial laminates and insulating materials in the Detroit office at 9101 E. Jefferson Ave.

Lunn Laminates, Inc., has moved its plant and offices to Oakwood Rd. and West 11 St., Huntington Station, N. Y.

Popper & Sons, Inc., 300 Fourth Ave., New York, N. Y., has formed a new department to handle distribution of Rejafix printing machines, which are used to mark and print on plastics products.

Loma Plastics, Inc., 3000 West Pafford St., Fort Worth, Texas, has added 10,000 sq. ft. of warehouse space to its present facilities.

Naugatuck Chemical Div., U. S. Rubber Co., announces the following organizational changes in its research and development department: **Dr. C. D. McCleary** has been named manager of basic research; **Dr. J. N. Judy** succeeds him as manager of process development; **C. G. Durbin** takes Dr. Judy's place as manager of technical services laboratories; **Ivan Mankowich** has been named manager of reclaim development.

The Division also announces the opening of a new southwestern branch office at 1480 No. Thomas St., Memphis, Tenn., for the sale of rubber and plastic latices used in paints, adhesives, industrial gloves, and paper and textile coating.

F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia, Pa., has appointed **Joseph D. Robertson** and **Robert M. Krause** to its Philadelphia and Cleveland offices, respectively.

Wayne Plastics Corp., Fort Wayne, Ind., has been formed as a successor to **Wayne Plastic Products, Div. of Wayne Home Equipment Co.**, and has taken over all facilities of the former organization. It is equipped to do custom molding of all thermosetting and thermoplastic materials.

President of the newly-formed company is **Robert H. Fletcher**, who is also president of **Richardson Rubber Co.** in Fort Wayne. **Phillip A. Leonard** is general manager and treasurer. Sales representatives are **Roger E. Valentine, Dan J. Cashman**, and **R. W. Paul. Barrier-Pribble & Co., Inc.**, plastics engineers, have been engaged as consultants.

Ampco Metal, Inc., 1745 South 38 St., Milwaukee, Wis., has appointed **Upton, Bradeen & James Ltd.**, Toronto, Ontario, Canada, as exclusive distributor of Ampco Weld resistance welding tips, dies, bushings, etc.

Imco Container Corp., 3823 Independence Ave., Kansas City, Mo., has been formed to handle sale of the plastic containers manufactured by **Injection Molding Co., Flexcel Container Co.**, and **Excelsior Plastics Co.**, all of Kansas City. President of the new company is **W. K. Archer.**

Henry Dreyfus, 4 West 58 St., New York, N. Y., industrial designer, announces that **Julian G. Everett, Robert H. Hose**, and **William F. H. Purcell** have recently become partners in the firm.

Dunnican Associates, 352 Plymouth Rd., Union, N. J., has been appointed sales representatives by **Gordon Chemical Co.**, Wilmington, Del., for the latter's Uramol urea molding materials in New Jersey and New England areas. Dunnican continues to represent **Synvar Corp.** in the sale of phenolic molding materials and industrial synthetic resins.

Watson-Stillman, Roselle, N. J., has named the following personnel to new executive positions: **R. S. Sweeney**, a director; **James W. West, Jr.**, assistant to the president; **A. B. Diss**, vice president in charge of manufacturing; **R. W. Dinzl**, consulting engineer; **Adolph deMatteo**, chief engineer; **R. W. Schreck**, general manager of sales, and **Herbert E. Elliott**, sales manager, in the Hydraulic Div.; **Jackson Kemper**, general manager of sales, and **John P. Bittenbinder**, sales manager, in the Distributor Products Div.; **Walter R. Biedermann**, industrial engineer, and **Elsworth Falkenberg**, plant manager.

Victory Plastics & Embossing Corp., 340 Bond St., Brooklyn, N. Y.,

R. L. Smith, Chief Engineer, and W. E. Foster, Assistant Sales Manager, of General Industries examine one of their products . . . a record player cabinet, perfectly molded from preforms uniformly heated and cured with THERMEX Electronic Heating Equipment.

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A TOTAL of 60 THERMEX® Plastic Preheating Units of 184 kilowatts capacity are on the job at The General Industries Company, Elyria, Ohio. Many of these units have been in constant service for as long as six years. According to this world's largest independent manufacturer of plastics products, this plant-wide installation has proved highly dependable and profitable . . . giving *faster production, more uniform cures* and *lower costs.*

Find out how *you* can benefit from THERMEX Preheating Apparatus. A THERMEX Engineer will gladly analyze your problems. Call today or write The Girdler Corporation, Thermex Division, Louisville 1, Kentucky.

Operator closes sliding drawer of 7½-kilowatt THERMEX Plastic Preheating Unit, and high-frequency power comes on automatically. After pre-set interval, power is shut off by timer. Foolproof operation improves quality control.

THERMEX — T. M. Reg. U. S. Pat. Off.

The GIRDLER Corporation

THERMEX DIVISION

PLASTISCOPE

has named **Carl Frye** as sales promotion manager. His headquarters are in the company's new eastern sales office at 172 Madison Ave., New York, N. Y.

Society of Plastics Engineers, Chicago Chapter, has elected the following new officers: president, **Maurice Meltzer,** Service Plastics, Inc.; vice president, **John T. Bent,** Tennessee Eastman Co.; and secretary-treasurer, **Victor E. Serrell,** Bakelite Co.

Libbey-Owens-Ford Glass Co. has established a district sales office for its **Fiber Glass Div.** at 120 S. LaSalle St., Chicago, Ill., under the direction of **Mark J. Wells.**

American Agile Corp., P.O. Box 168, Bedford, Ohio, has completed a new 12,500 sq. ft. plant at 5461 Dunham Rd., Maple Heights, Ohio, for the manufacture of custom built and standard corrosion resistant bottles, containers, tanks and tank liners, pipe lines, and equipment for the chemical and allied industries.

Bowen Engineering, Inc., has announced completion of a new test laboratory at North Branch, N. J.

PERSONAL

Samuel S. Oleesky has been appointed chief engineer, **Research & Development Div., Reinforced Plastic Consultants & Engineers,** Gardena, Calif. He was formerly head of Radome Section, U. S. Naval Air Development Center, Johnsville, Pa.

Robert N. Nelson, formerly assistant sales manager, has been promoted to sales manager of the **Pneumatic Div., Sundstrand Machine Tool Co.,** 2531 11th St., Rockford, Ill.

James R. Hughes has been named manager of a new district office of **Sterling Electric Motors, Inc.,** at 1726 Champa St., Denver, Colo.

Gordon Groth has been appointed vice president and general manager of the **Plastics Div., Erie Resistor Corp.,** Erie, Pa.

A. R. Kemp, a leading authority on rubber and plastics and formerly associated with Bell Telephone Laboratories, has joined **Narmco, Inc.,** 930 West Grape St., San Diego, Calif., as vice president. He is in charge of research on new products in the company's plants at Costa Mesa and San Diego.

Charles A. Cox, formerly with Roger's Plastic, has been named general sales manager of **Rona Plastic Corp.,** 1525 Blondell Ave., New York, N. Y.

Robert W. Bainbridge has been appointed coordinator of military applications for **Durez Plastics & Chemicals, Inc.,** North Tonawanda, N. Y.

Sydney W. Lohman has been appointed New England representative for plastics equipment for **Lester-Phoenix, Inc.,** Chester-Twelfth Bldg., Cleveland, Ohio.

William M. Shine has been appointed director of **Market Development** for **Arnold, Hoffman & Co., Inc.,** Providence, R. I. His headquarters are at the company's New York office, 521 Fifth Ave. Mr. Shine joined the firm in 1950 and was previously with General Aniline & Film Corp.

George P. O'Neil has been named sales representative for **Auburn Button Works, Inc.,** Auburn, N. Y., in the western Pennsylvania area. Mr. O'Neil is also vice president of **Allegany Plastics Co.,** Sewickley, Pa.

Vincent D. McCarthy has been appointed head of national sales promotion for Ger-Pak polyethylene packaging film and extruded products produced by **Gering Products, Inc.,** North 7 St. and Monroe Ave., Kenilworth, N. J.

John B. Alfers is one of five Navy Dept. employees who has been given a Distinguished Navy Civilian Service Award by Navy Secretary Kimball. Mr. Alfers is a Bureau of Ships materials engineer well known to the industry for his development work in the field of plastics.

Ralph R. Browning, Jr., has been appointed to the staff of the **Vinyl Plastics Dept., Interchemical Corp.** Mr. Browning, whose headquarters are in the firm's New York office at 67 West 44 St., will concentrate on technical promotion of foaming and conventional plastisols, plastigels, finishes for elastomeric leather, and other new products in the flexible plastics field. Mr. Browning joined Interchemical in 1948 to head the technical sales of industrial vinyls for the Coated Products Div.

John W. Waldron has been named by **Pyro Plastics Corp.,** Union, N. J., as engineering sales manager, a position created when the firm recently expanded in the field of custom injection molding.

John C. Chamberlin has been transferred to the molding powders section of the plastics sales department of **The Dow Chemical Co.** at Midland, Mich. **Frank C. Kenyon** succeeds Mr. Chamberlin in the St. Louis office.

MEETINGS

Apr. 1-4—National Packaging Exposition, 21st Annual Conference, Atlantic City Auditorium, Atlantic City, N. J.

Apr. 9-11—Society of the Plastics Industry, Seventh Annual Technical Session, Reinforced Plastics Div., Edgewater Beach Hotel, Chicago, Ill.

May 11-14—American Institute of Chemical Engineers, French Lick Springs Hotel, French Lick, Ind.

June 9-21—International Organization for Standardization, Triennial Meeting, Columbia University, New York, N. Y.

June 23-25—Forest Products Research Society, Sixth Annual National Meeting, Milwaukee, Wis.

June 23-27—American Society for Testing Materials, 50th Anniversary and Annual Meeting, Hotels Statler and New Yorker, New York, N. Y.

S.P.E. Meetings

Apr. 9—Monthly meeting of Newark Section, Military Park Hotel, Newark, N. J. Earl E. Zeigler, The Dow Chemical Co., Midland, Mich., will talk on "Static Dust Collections on Plastics."

May 14—Monthly meeting of Newark Section. Dr. M. H. Bigelow Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio, will deliver a talk on "Reinforced Plastics."

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PLASTICIZER-STABILIZER

PARAPLEX G-60 is a polymeric plasticizer and stabilizer for vinyl resins. It readily meets processing requirements in rigorous, high speed, high temperature schedules—has the permanence needed in virtually every vinyl application. Cost is low. For a convincing demonstration, ask for a sample of PARAPLEX G-60.

For general use or specialties, one of the PARAPLEX or MONOPLEX plasticizers should meet your needs. Write for this 43-page plasticizer manual.

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FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 16" x 48", and 15" x 36", 2 roll rubber mills. New 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Other sizes up to 84". Royle #½ and #2 extruders, also other sizes. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. Francis 175 ton 24" x 18". W.S. 115 ton 24" x 24". Also presses Lab. to 1500 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250# WP. Worthington 23 GPM, 2500 PSI., Triplex Hydr. Pump. W.S. 4 Plgr. High and low Pressure Hydr. Pump. HPM 10 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Closed Steel ASME Pressure Tank 275 PSI. 1200 gals. Stokes Automatic Molding Presses. Rotary & Single punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins jacketed mixers 200, 9 & 4½ gals. Ball & Jewell & Leominster Plastic Grinders. Mikro Pulverizers 2 DH, 10 HP & other sizes. Heavy duty mixers, grinders, pulverizers, gas boilers etc. Partial listing. We buy your surplus machinery. Stein Equipment Co. 90 West Street, New York 6, N.Y. WOrth 2-5745.

FOR SALE: 1 Stokes DD2 Rotary Tablet Machine, Vari-Speed Drive and motor; 1—Farrel 16" x 42" Rubber Mill complete with drive and 75 H.P. Motor; 2—Ball & Jewel #2 Rotary Cutters, 50 H.P. Motors. Also Grinders, Extruders, Compression and Injection Molding Presses, Mixers, etc. Send us your inquiries. Consolidated Products Co., 13-14 Park Row, New York 38, New York.

FOR SALE: 50 Ton Stokes Presses & Pump, 200 Ton W.S. Hobbing PRESS, 300 Ton W.S. PRESS 24 x 20 Platen, 175 Ton H.P.M. PRESS 30 x 30 Platen, 150 Ton Farrel PRESS 30 x 30 Elec. Plates, 140 Ton W.S. PRESS 23 x 17 Platens, 65 Ton Stewart Bolling PRESS 20 x 20 Platen, 50 Ton Elmes PRESS with 18 x 18 Elec. Plates, 75 Ton W.S. PRESS 15 x 15 Platen, 75 Ton Adamson PRESS 20 x 20 Platens. Laboratory presses. Accumulators, Piston and Oil Pumps. AARON MACHINERY CO., INC. 45 Crosby St., N.Y.C.

We handle hydraulic presses, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. Hydraulic Sal-Press, Inc., 386-90 Warren Street, Brooklyn 2, N.Y. Main 4-7847

SAVE WITH GUARANTEED REBUILT EQUIPMENT—RUBBER MIXING MILL, heavy duty 18"x48"; HYDRAULIC PRESSES: 28" x 25" 18" ram, 400 tons; 36" x 36" 16" ram, multiple opening, 250 tons; 37" x 37" 30" ram, multiple opening 1060 tons; 20" x 20" 10" ram, 200 tons; 22" x 15" 8" ram, 75 tons; 14" x 14" 8" ram, 75 tons; 12" x 12" 8" ram, 75 tons; 19" x 24" 10" ram, 78 tons; 18" x 16" 7½" ram, 60 tons; 12" x 12" 7½" ram, 60 tons; 14" x 14" 8" ram, 50 tons; 12" x 12" 6½" ram, 50 tons; 8" x 9½" 4½" ram, 20 tons; 16" x 16" 3½" ram, 12 tons; LABORATORY PRESSES: 10 ton 6" x 6" Carver, 20 ton 8" x 8" Carver; NEW UNIVERSAL DUAL PUMPING UNITS; 3 to 15 HP; NEW LABORATORY MILLS & CALENDERS; EXTRUDER: Royle #1 Plastic, insulating type; ACCUMULATOR; HPM 6" ram 2500#; Preform Presses all sizes, also Mixers, Vulcanizers, Injection Molding Machines, etc. Universal Hydraulic Machinery Co. Inc. 285 Hudson Street New York City 13, N.Y.

FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater, Model C E. Like new. AARON MACHINERY CO., INC. WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

FOR SALE: Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars address Box 1470, Modern Plastics.

FOR SALE: OVEN, Electric—Lydon Bros. 450° F, 5 KW. Cabinet type with four drawers 28" x 18" x 2½", removable for large single space. Suitable for plastics, or baking and drying finishes and powders. Internal and external circulation. Complete with all controls, timers, etc. New condition. Originally $1000. Sell $450. A very fine bargain. Tera Laboratories, Gaithersburg, Md.

FOR SALE: Van Dorn Midget Molding Press—Model 1—Capacity one ounce hand operated—complete with heating coils and thermostats—Excellent condition. PRECISION PRODUCTS COMPANY, 26 Bedford St., Waltham 54, Mass.

FOR SALE: MODERN HYDRAULIC PRESSES—4000 ton Downstroke Hydraulic Press by John Shaw & Sons; table 7' x 4'; daylight 6'; ram 42" diameter.—3000 ton 6-daylight John Shaw Board Press; fitted steam platens 9' x 4'4" with self-contained Pumping Equipment.—2400 ton Sheeting or Belting Press by Hydraulic of Duisburg; steam platens 18' x 7'4"; with self-contained Air Hydraulic Accumulator and Pump.—2000 ton 6-daylight Press by Greenwood & Batley; fitted steam platens 6'4" x 3'3", with loading and unloading gear.—2000 ton Downstroke Hydraulic Press by Fielding & Platt; table 5' square; daylight 6'.—Also many large Hydraulic Accumulators, Pumps, etc., in stock. Reed Brothers (Engineering) Ltd., Replant Works, Cuba St., Millwall, London. E.14. Cables REPLANT LONDON.

FOR SALE: Boiler 5 H.P. 150 lb. pressure complete with all accessories and return unit, gas fired, new in 1951, guaranteed. THE GEO. S. SCOTT MFG. CO., Wallingford, Conn.

FOR SALE: Injection Presses 9,16 oz HPM, 9 oz HPM Cylinder, 6 oz Reed. 8 oz Lester. 8 oz, 24 oz Watson. 32 oz Impco. 2 oz DeMattia. 1 oz VanDorn. Extruders: 1" NRM Benchlab. NRM 40' Conveyor, 10' Cooling Trough. Edmands Wire Twinner. Serapgrinders. Ovens. 100,250 tons Transferpresses, 50,250,600 tons Compressionpresses. Colton E. Stokes T, Kux 60 B Preformpresses. Nash Rotaryedger. Sheridan Embossingpress. 7½ HP Vacuumpump. Large Deepdraw Vacuumpress assembly. 42" Johnstone Slittingmachine. List your surplus equipment with me. Justin Zenner, 823 W Waveland Ave., Chicago 13, Ill.

FOR SALE: No. 1 John Royle Extruder, cored for oil heating, 2" stainless steel screw, 30" long Xalloy lined cylinder, and complete with 7½ HP variable speed motor drive, jacketed swing head, agitated feed hopper. Practically new and in perfect condition. Reply Box 1460, Modern Plastics.

FOR SALE: Gould Triplex Pump, Size 2 x 8, Fig. 1841, Serial 516601, Maximum Pressure 4000 lbs PSI, Capacity, 24 Gal. PM. Presently equipped with 40 HP Motor and V Belt Drives and we have Spare set of plungers. Excellent condition, subject to inspection at our plant. Will be available about April 1, 1952. DIEMOLDING CORPORATION, Canatota, New York.

FOR SALE: Used Hobbing Press as follows: Complete with 3-three vertical hyd. pump and 7½ HP motor 550-3-32 cycle and heat treated chassis of verious sizes. Capacity—1000 tons; Max. width of chase-15¾; Dia. of Anvils-12" approx.; Min. & Max. gap between anvils 0-10-7/16; Max. speed-3½" per min.; Approx. weight-5 tons; Price-$4,000 f.o.b. our Plant Toronto. This machine has had very little use and is in excellent condition and can be seen in operation at Modern Tool Works, 69 Montcalm Avenue, Toronto, Ontario, Canada.

FOR SALE: One 6" heavy duty National Rubber Tuber complete with swing gate 75 HP H.D. motor and Reliance 75 KW V.S. drive; New—available for immediate delivery. Reply Box 1457, Modern Plastics.

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1-oz. VAN DORN Model H200; 1947 ..offers
2-oz. HPM(2); Leominster, new '49 ..$2250 up
4-oz. HPM & W.S. ser #9730 class $5600
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1½-12-16-22-32-oz. IMPCO'S, REEDS, '49 up ..$7500 up

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HARTIG 1¼" & 3½" Mod. 500; good condition ..$3500
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HPM, 1300,450,350 ton; new '45; .....offers
WATSON St. 275-225 ton; 24x55, 24x24 ..$2975 up
WATSON St. 50T; auto. mold mchne. new '44 ..$6500
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Stokes 90 D Auto. Tube Filler and Closer. Colton 2 and 3 RP Rotary Tablet Machines. Mikro 15H, 3TH, 4TH Pulverizers; Jay Bee and Schutz O'Neill Mills. Baker Perkins & Readco Heavy Duty Steam Jacketed, Double arm 50, 100, 150 gal. Mixers. Baker Perkins 150 gal. D.A. Unidor Jacketed Mixer. Baker Perkins 100 gal. D.A. Vacuum Mixers. 1, 3, Day 75 & 55 gal. Imperial and Cincinnatus D.A. Jacketed, Sigma Blade Mixers. Hobart & Read Vertical Mixers, from 15 to 120 quart, with removable bowls. Day & Robinson 100 up to 4000 lbs. Dry Powder Mixers. Pony ML and MX and Auto. Duplex Labelrites. Package Machy. FA, FA2, Miller, Hayssen 3-7, Scandia Auto. Cellophane Wrappers. This is only a partial list. Over 5000 machines in stock—available at tremendous savings. Tell us your machinery requirements. UNION STANDARD EQUIPMENT, 318-322 Lafayette St., New York 12, N. Y.

FOR SALE: Kux Model-25 Rotary Presses, 21 punch and 25 punch. Stokes models D-3 and D-4 Rotary Presses, 16 punch. Read 600# Jacketed Ribbon Mixer. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila., 22, Pa.

MACH. AND EQUIP. WANTED

WANTED! WANTED! WANTED! INJECTION MOLDING MACHINES, AND PRESSES, ALL SIZES. ALSO ANY OTHER PLASTIC OR HYDRAULIC MCHNRY. Superior Machine Tool Co., 403 Housatonic Ave. Bridgeport, Conn. 5-3990.

WANTED: To Expedite Production—Rubber Making Machinery including Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set up plant now operating or shut down. When offering give full particulars. P.O. Box 1351, Church Street Sta., New York 8, N. Y.

WANTED: REED PRENTICE 8-oz. or 12-oz. or HPM 9-oz. Must be post-war models. Send full particulars to Box 1442, Modern Plastics.

WANTED: Preform Press to make 3" round preform. Defiance #20 or equal. Reply Box 1454, Modern Plastics.

WANTED: 32 oz. or larger injection molding presses (3). Must be in excellent condition and late models. We are moiders. In reply state all particulars and location of equipment. Reply Box 1472, Modern Plastics.

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FOR SALE: Large plastic scrap dealer can offer tonnage quantities of Thermoplastic scrap for sale, both separated lots and mixed scrap at prices below market. Samples and quotations on request. Polystyrene, Acetate, Butyrate, Acrylic, Vinyls. Reply Box 1445, Modern Plastics.

FOR SALE: Approximately 15 tons Cellulose Acetate Sheet Material (British made) Thicknesses 1 mm. to 6 mm. in all colours. Standard size sheets. Material in stock in England @ Sterling prices. Reply Box 1453, Modern Plastics.

FOR SALE: Polyethylene, natural first run reground gates and sprues. About 3,000 lbs. monthly. Regular supply. Will pelletize if desired. Reply Box 1455, Modern Plastics.

MATERIALS WANTED

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystrene, Vinyl, Acrylic; Ethyl Cellulose. Reply Box 1437, Modern Plastics.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. Franklin Jeffrey Corporation, 1671 McDonald Avenue, Brooklyn, N. Y. ES 5-7943.

WANTED: PLASTIC Scrap or Rejects in any form, Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 1436, Modern Plastics.

(*Continued on page 208*)

CLASSIFIED ADVERTISING

(Continued from page 206)

WANTED: Plastic scrap such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. Claude P. Bamberger, Inc., 152 Centre St., Brooklyn 31, N. Y. Tel. Main 5-5553. Not connected with any other firm of similar name.

SURPLUS UREA MOLDING POWDER WANTED. Reply Box 1438, Modern Plastics.

WANTED: By injection molder—Polystyrene molding powder in any form: scrap, reground, mixed colors, surplus virgin, etc. will purchase on contract basis if desirable. Send samples and best quotations to Waldor Products Molding Co., 132 Mallory Ave., Jersey City, N.J.

WANTED: Large quantities of Reground or Virgin Polystyrene, Acetate and Butyrate in solid colors. We are interested in obtaining a steady supply of these materials. Please send color samples and full description of the materials as well as prices. Reply Box 1458, Modern Plastics.

WANTED: Phthalic, Maleic, Phenol, Glycols, DOP, DMP, Cresylic Acid, Tricresyl Phosphate, Other Plasticizers, Plastics, etc. CHEMICAL SERVICE CORP., 98-04 Beaver St., New York 5, N. Y.

WANTED: Large quantities vinyl, polyethylene and clear cellulose acetate scrap, ground or unground. We also buy other grades of thermoplastic scrap. New England's largest exclusive buyers. The Blane Corp., 35 Troy St., Boston, Mass.

MOLDS WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resalable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to Victory Manufacturing Company, 1722 W. Arcade Place, Chicago 12, Illinois.

MOULD WANTED: For injection molded toy automobile, approx. 6-7" long. E. J. KAHN CO., 429 W. Superior St., Chicago, Ill.

HELP WANTED

PLASTIC DIVISION—NIGHT SUPERINTENDENTS: Two high caliber men needed to handle supervision of night shift's at large Chicago concern, engaged in injection, molding, extrusion and sheet-forming. This is not a Foreman's job. Mechanical Engineer preferred but not essential—Salary open—send complete resume of education and experience. Reply Box 1439, Modern Plastics.

PLASTICS TECHNICIAN
Excellent opportunity for a plastics technician with a national rubber corporation. Assignment in Montevideo, Uruguay. Must have manufacturing experience in plastic molding, injection, and plastic sheeting. Please forward complete resume stating educational background, experience, and salary expected. Reply Box 1440, Modern Plastics.

WANTED: By growing midwestern custom injection molding company a thoroughly experienced injection plastic molder. An opportunity for the right man to grow right along with us. Give full particulars and qualifications in letter. All replies confidential. Reply Box 1451, Modern Plastics.

PROJECT ENGINEER, preferably M.E. to handle product development of all thermoplastics with progressive New England company. Experience in thermoplastics desirable but not essential. Send complete resume giving education, experience and salary commanded or required in first letter to Box 1459, Modern Plastics.

VINYL COATING ENGINEER—Experienced in organisols and plastisols. Furnish details of experience first letter. Reply Box 1456, Modern Plastics.

SALESMEN FOR ESTABLISHED CHICAGO INJECTION MOLDER with capacity to 200 oz. Prefer experience in plastics and capable of giving some engineering service to customer. Will consider men controlling one account or deal. Men required in all industrial areas plus man for Chicago office. Applicant assured excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Give complete details to Box 1441, Modern Plastics.

TECHNICAL SERVICE REPRESENTATIVE: One of leading chemical companies needs technical service representative to many other industries on industrial resins, particularly the laminating type. Engineering background, sales personality and diligence essential. Will also act as liaison among various intra-company groups. Considerable traveling involved. Opportunities for progress are excellent. Prefer man 25-30 years of age. Please give qualifications and salary requisites in reply to Box 1443, Modern Plastics.

SALESMAN: Aggressive, for large well established midwest molder. Must have sales experience and thorough knowledge of plastics, injection and compression molding. An excellent opportunity for a man who would like to become associated with old reliable and rapidly expanding firm, doing all types of plastic molding. Large expansion program for fibre glass molding about completed. Only high caliber experienced man under 45 years of age will be considered. Must have good earning record and excellent references. All replies strictly confidential. Koller Craft Plastic Products, Inc., Fenton, Mo. (St. Louis Suburb) Tel. Victor 3-4116.

CHEMIST: Graduate or equivalent experience for development and control work in plastic coating division of an established paper manufacturer in the Miami Valley. Good starting salary—Vacation with pay—Hospital care, group insurance and other employee benefits. Send resume with photograph and salary requirements. Reply Box 1463, Modern Plastics.

VINYL PLASTICS CHEMIST: Georgia manufacturer requires man with broad background in Vinyl Plastic dipping and curing to manage such an operation. Compensation and opportunity for advancement excellent. Please submit applications in your own handwriting, giving experience, age, family status. All replies will be held in confidence. Reply 1464, Modern Plastics.

EXTRUSION OPERATOR: Must be experienced in wire covering—write giving experience to Clear Beam TV Antennas, 100 Prospect, Burbank, Calif.

ASSISTANT TO THE MANAGER
Modern expanding plastic Company in Chicago has an opening for a young man with executive ability and practical experience in plastic molding and fabricating plant. Give all information in first letter. Reply Box 1465, Modern Plastics.

WANTED: Plastics engineer, not over 35. Technical graduate preferred. About ten years' experience in development and production. Excellent opportunity for advancement in well established organization. Products in industrial rather than novelty field. Reply giving full resume of training & experience. Box 1466, Modern Plastics.

INJECTION MOLDING FOREMAN: Unusual opportunity in expanding department of large, long established jewelry manufacturer in Providence, R. I. Man with technical knowledge and supervisory ability will receive high starting salary with excellent chance for advancement. References must stand rigid investigation. Write full details, including latest salary figures to Box 1467, Modern Plastics.

SALES ENGINEER—VINYLS: A leading manufacturer's expansion program creates a need for a technical serviceman. Some sales experience and a technical education preferred but not essential. Should be familiar with compounding and processing polyvinyl chloride resins in the manufacture of some of the following: calendering film and sheeting, coated fabrics, insulated wire and cable, extruded profile shapes. Must travel. Our staff knows of this opening. Mail in confidence your complete qualifications to Box 1468, Modern Plastics.

ASSISTANT FOREMAN: Assembly and paint spraying dept of well-known injection molding plant on Long Island, N. Y. Must know lacquers, build jigs & fixtures and how to instruct operators. Steady employment and good pay for right man. Send complete resume of past experience, education and earnings. Box MP 1995, 221 W. 41 St. N. Y.

SALESMAN—VINYLS: A leading manufacturer's expansion program creates a need for a territory salesman. A technical training in vinyl resins as applied to calendering film and sheeting, textile coating, wire and cable insulation, extruded profile shapes in desired but not essential. Must be willing to relocate in the U. S. Our staff knows of this opening. Mail in confidence your complete qualifications to Box 1469, Modern Plastics.

EXCEPTIONAL OPPORTUNITY — PLANT MANAGER, production and control experience, by AAA 1 CORP. now in paper coating. Essential: chemical degree and experience polyethylene, vinyl extrusion-emulsion coating of paper and cloth. Experience in carton manufacturing field, laminating, gravure printing, calendering, desirable but not essential. Location near Chi. Strictly confidential. Box 1471, Modern Plastics.

SITUATIONS WANTED

VINYL CHEMIST—30, B. S. Chemistry, married, family. 6 years experience in calendering, compounding, and testing film and sheeting. Familiar color matching, scrap reworking, and raw materials evaluation. Have worked in both laboratory and production. Experienced labor relations. Will relocate and consider foreign employment. Reply Box 1444, Modern Plastics.

PLASTIC INJECTION MOLDING PLANT MANAGER: Intelligent hard worker, aggressive, 8 years injection molding experience, thoroughly reliable, married, age 29, desires position as supervisor or manager of small plant. Fully familiar all phases of plant operation, set-up and maintenance of machines, molds, organizing personnel, etc. Presently in charge of injection molding department but seeking better opportunity New York area. Best references. Reply Box 1446, Modern Plastics.

Young man, 28, college grad, married, wants future in Reinforced-Laminated plastics. Desires association with progressive firm bent on automotive or allied products in sales, promotion or assistant to executive capacity. Has ideas to contribute. 6 years varied experience with small metal products manufacturer, mostly sales and promotion. Prefer New England but will relocate for good opportunity. Excellent references. Reply Box 1447, Modern Plastics.

Does your plant need a thoroughly trained compression-injection man with twenty years experience, to serve as superintendent or production mgr., to iron out and expedite production? Married, age 42, with many years experience in organizing & handling personnel. Am able to assume complete responsibility for entire operation. Able to furnish reliable references in the industry. Availability, 2 weeks. Reply Box 1449, Modern Plastics.

PLASTICS PRINTER: Wide background of experience. Seven years, printing plastics, including Polyethylene, packaging material, Vinyl calendered films also molded products. Plastics bags, drapes, tablecloths, radio dials etc. One to four colors, Aniline, Gravure and Silk Screen Printing. Four years experience handling help. Ambitious young man with good recommendations of high grade work. Reply Box 1450, Modern Plastics.

Desires part time engineering and mold designing work in compression and injection molding. Reply Box 1454, Modern Plastics.

COATINGS CHEMIST: Thoroughly familiar all types of vinyl coatings, plastisols, organosols, solutions, printing inks etc. Knowledge of resins, plasticizers, and related materials. Experienced in formulations for flameproofing cotton duck, burlap etc. per government specifications. Desire responsible position in these or allied fields where imagination and initiative can be utilized. New England or adjacent area only. Age—29. Married. Reply Box 1462, Modern Plastics.

MISCELLANEOUS

Graduate chemical engineer with twenty years of on the job plastic manufacturing experience in injection-compression and low pressure molding, desires to locate some individual or company interested in investing with me in setting up a modern molding plant. Would prefer someone interested in sales but have good volume of work to start on. Reliable references gladly furnished. Reply Box 1448, Modern Plastics.

WANTED: Company with mold in stock to supply transparent plastic champagne glasses in large quantities. L.B.A. Company, 501 First Ave., New York 16, N. Y.

WANT TO BUY: Custom Molding Plastics Plant equipped for Compression, Transfer and/or Injection Molding. Situated on or near East Coast. Advise equipment, facilities, and area in letter. Reply Box 1461, Modern Plastics.

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EFFECTIVE WITH MAY, 1952 OUR RATES WILL BE AS FOLLOWS:

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For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

INDEX OF ADVERTISERS

APRIL 1952

MODERN PLASTICS

575 MADISON AVENUE • NEW YORK 22, N.Y.

Eye catchers and sales catchers

You can't miss these signs—they're bright and colorful, shaped to three dimensions. They're real bargains themselves . . . low in cost, wearing like iron, washable . . . for they're made from VINYLITE Rigid Sheets, multicolor printed, then deep-drawn into durable, lightweight, easily cleaned displays.

They're perfect examples of the versatility of VINYLITE Rigid Sheets. They'll hold their shape and dimensions regardless of changes in temperature and humidity. They're strongly resistant to oils, greases, water, alkalies, most strong acids. Perspiration and dirt won't harm them—they can be wiped clean with a damp cloth.

VINYLITE Rigid Sheets come in all colors — transparent, translucent, or opaque. They won't warp or crack with rough handling, and have useful electrical insulation qualities.

Their military and civilian uses range from precision instruments to ceilings, and they're giving more ideas to manufacturers and designers every day.

Perhaps you, too, can develop a better-looking, better-working, more profitable product from VINYLITE Plastic Rigid Sheets. For more information, write Dept. LZ-7.

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G.E.'s COMPLETE MOLDING SERVICE OFFERS YOU—

- Complete mold-making facilities
- Impartial material selection
- Injection presses from 3 to 208 ozs.
- Compression presses from 3 to 36 ins.
- Complete extrusion facilities
- Complete silicone rubber fabricating facilities
- Complete molded mycalex facilities

PLUS the benefit of 60 years' experience in designing, engineering and molding plastics parts.

How would you like to be able to obtain six or eight *different-looking* plastics parts—using only *one* set of molds?

Fantastic? Not at all . . . General Electric design engineers have created a *basic form* for a radio housing around which a variety of different-looking cabinets can be styled by a simple change of dial knobs, speaker panels or other extraneous parts. The manufacturer of these radios benefits from savings in retooling and mold-making . . . obtains maximum usage from the one set of molds.

This example is typical of the way General Electric's *complete* molding service can help you cut costs in obtaining the plastics parts you need. G.E., one of the world's largest plastics molders, offers you not only tremendous molding facilities but the creative engineering and impartial material choice that can mean low-cost, high-quality plastics parts.

Why not find out more about G.E.'s *complete* molding service? G.E. will be glad to work with you on *any phase* of plastics molding. Just write to General Electric Company, Section M-1, Chemical Division, Pittsfield, Massachusetts.

You can put your confidence in—

GENERAL ELECTRIC